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THE NAUTICAL ALMANAC 2011

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THE NAUTICAL ALMANAC 2011

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A2 ALTITUDE CORRECTION TABLES 10°-90°—SUN, STARS, PLANETS

SUN

OCT.—MAR. App. Alt.	Lower Limb	Upper Limb	APR.—SEPT. App. Alt.	Lower Limb	Upper Limb
° ′	′	′	° ′	′	′
9 33	+10·8	−21·5	9 39	+10·6	−21·2
9 45	+10·9	−21·4	9 50	+10·7	−21·1
9 56	+11·0	−21·3	10 02	+10·8	−21·0
10 08	+11·1	−21·2	10 14	+10·9	−20·9
10 20	+11·2	−21·1	10 27	+11·0	−20·8
10 33	+11·3	−21·0	10 40	+11·1	−20·7
10 46	+11·4	−20·9	10 53	+11·2	−20·6
11 00	+11·5	−20·8	11 07	+11·3	−20·5
11 15	+11·6	−20·7	11 22	+11·4	−20·4
11 30	+11·7	−20·6	11 37	+11·5	−20·3
11 45	+11·8	−20·5	11 53	+11·6	−20·2
12 01	+11·9	−20·4	12 10	+11·7	−20·1
12 18	+12·0	−20·3	12 27	+11·8	−20·0
12 36	+12·1	−20·2	12 45	+11·9	−19·9
12 54	+12·2	−20·1	13 04	+12·0	−19·8
13 14	+12·3	−20·0	13 24	+12·1	−19·7
13 34	+12·4	−19·9	13 44	+12·2	−19·6
13 55	+12·5	−19·8	14 06	+12·3	−19·5
14 17	+12·6	−19·7	14 29	+12·4	−19·4
14 41	+12·7	−19·6	14 53	+12·5	−19·3
15 05	+12·8	−19·5	15 18	+12·6	−19·2
15 31	+12·9	−19·4	15 45	+12·7	−19·1
15 59	+13·0	−19·3	16 13	+12·8	−19·0
16 27	+13·1	−19·2	16 43	+12·9	−18·9
16 58	+13·2	−19·1	17 14	+13·0	−18·8
17 30	+13·3	−19·0	17 47	+13·1	−18·7
18 05	+13·4	−18·9	18 23	+13·2	−18·6
18 41	+13·5	−18·8	19 00	+13·3	−18·5
19 20	+13·6	−18·7	19 41	+13·4	−18·4
20 02	+13·7	−18·6	20 24	+13·5	−18·3
20 46	+13·8	−18·5	21 10	+13·6	−18·2
21 34	+13·9	−18·4	21 59	+13·7	−18·1
22 25	+14·0	−18·3	22 52	+13·8	−18·0
23 20	+14·1	−18·2	23 49	+13·9	−17·9
24 20	+14·2	−18·1	24 51	+14·0	−17·8
25 24	+14·3	−18·0	25 58	+14·1	−17·7
26 34	+14·4	−17·9	27 11	+14·2	−17·6
27 50	+14·5	−17·8	28 31	+14·3	−17·5
29 13	+14·6	−17·7	29 58	+14·4	−17·4
30 44	+14·7	−17·6	31 33	+14·5	−17·3
32 24	+14·8	−17·5	33 18	+14·6	−17·2
34 15	+14·9	−17·4	35 15	+14·7	−17·1
36 17	+15·0	−17·3	37 24	+14·8	−17·0
38 34	+15·1	−17·2	39 48	+14·9	−16·9
41 06	+15·2	−17·1	42 28	+15·0	−16·8
43 56	+15·3	−17·0	45 29	+15·1	−16·7
47 07	+15·4	−16·9	48 52	+15·2	−16·6
50 43	+15·5	−16·8	52 41	+15·3	−16·5
54 46	+15·6	−16·7	56 59	+15·4	−16·4
59 21	+15·7	−16·6	61 50	+15·5	−16·3
64 28	+15·8	−16·5	67 15	+15·6	−16·2
70 10	+15·9	−16·4	73 14	+15·7	−16·1
76 24	+16·0	−16·3	79 42	+15·8	−16·0
83 05	+16·1	−16·2	86 31	+15·9	−15·9
90 00			90 00		

STARS AND PLANETS

App Alt.	Corrn	App. Alt.	Additional Corrn
° ′	′		
9 55	−5·3	**2011**	
10 07	−5·2	**VENUS**	
10 20	−5·1	Jan. 1–Feb. 18	
10 32	−5·0	°	′
10 46	−4·9	0	+0·2
10 59	−4·8	41	+0·1
11 14	−4·7	76	
11 29	−4·6	Feb. 19–Dec. 31	
11 44	−4·5	°	′
12 00	−4·4	0	+0·1
12 17	−4·3	60	
12 35	−4·2	**MARS**	
12 53	−4·1	Jan. 1–Dec. 31	
13 12	−4·0	°	′
13 32	−3·9	0	+0·1
13 53	−3·8	60	
14 16	−3·7		
14 39	−3·6		
15 03	−3·5		
15 29	−3·4		
15 56	−3·3		
16 25	−3·2		
16 55	−3·1		
17 27	−3·0		
18 01	−2·9		
18 37	−2·8		
19 16	−2·7		
19 56	−2·6		
20 40	−2·5		
21 27	−2·4		
22 17	−2·3		
23 11	−2·2		
24 09	−2·1		
25 12	−2·0		
26 20	−1·9		
27 34	−1·8		
28 54	−1·7		
30 22	−1·6		
31 58	−1·5		
33 43	−1·4		
35 38	−1·3		
37 45	−1·2		
40 06	−1·1		
42 42	−1·0		
45 34	−0·9		
48 45	−0·8		
52 16	−0·7		
56 09	−0·6		
60 26	−0·5		
65 06	−0·4		
70 09	−0·3		
75 32	−0·2		
81 12	−0·1		
87 03	0·0		
90 00			

DIP

Ht. of Eye	Corrn	Ht. of Eye	Ht. of Eye	Corrn
m	′	ft.	m	′
2·4	−2·8	8·0	1·0 – 1·8	
2·6	−2·9	8·6	1·5 – 2·2	
2·8	−3·0	9·2	2·0 – 2·5	
3·0	−3·1	9·8	2·5 – 2·8	
3·2	−3·2	10·5	3·0 – 3·0	
3·4	−3·3	11·2	See table ←	
3·6	−3·4	11·9		
3·8	−3·5	12·6	m	′
4·0	−3·6	13·3	20 – 7·9	
4·3	−3·7	14·1	22 – 8·3	
4·5	−3·8	14·9	24 – 8·6	
4·7	−3·9	15·7	26 – 9·0	
5·0	−4·0	16·5	28 – 9·3	
5·2	−4·1	17·4	30 – 9·6	
5·5	−4·2	18·3	32 – 10·0	
5·8	−4·3	19·1	34 – 10·3	
6·1	−4·4	20·1	36 – 10·6	
6·3	−4·5	21·0	38 – 10·8	
6·6	−4·6	22·0	40 – 11·1	
6·9	−4·7	22·9	42 – 11·4	
7·2	−4·8	23·9	44 – 11·7	
7·5	−4·9	24·9	46 – 11·9	
7·9	−5·0	26·0	48 – 12·2	
8·2	−5·1	27·1	ft.	′
8·5	−5·2	28·1	2 – 1·4	
8·8	−5·3	29·2	4 – 1·9	
9·2	−5·4	30·4	6 – 2·4	
9·5	−5·5	31·5	8 – 2·7	
9·9	−5·6	32·7	10 – 3·1	
10·3	−5·7	33·9	See table ←	
10·6	−5·8	35·1		
11·0	−5·9	36·3	ft.	′
11·4	−6·0	37·6	70 – 8·1	
11·8	−6·1	38·9	75 – 8·4	
12·2	−6·2	40·1	80 – 8·7	
12·6	−6·3	41·5	85 – 8·9	
13·0	−6·4	42·8	90 – 9·2	
13·4	−6·5	44·2	95 – 9·5	
13·8	−6·6	45·5	100 – 9·7	
14·2	−6·7	46·9	105 – 9·9	
14·7	−6·8	48·4	110 – 10·2	
15·1	−6·9	49·8	115 – 10·4	
15·5	−7·0	51·3	120 – 10·6	
16·0	−7·1	52·8	125 – 10·8	
16·5	−7·2	54·3	130 – 11·1	
16·9	−7·3	55·8	135 – 11·3	
17·4	−7·4	57·4	140 – 11·5	
17·9	−7·5	58·9	145 – 11·7	
18·4	−7·6	60·5	150 – 11·9	
18·8	−7·7	62·1	155 – 12·1	
19·3	−7·8	63·8		
19·8	−7·9	65·4		
20·4	−8·0	67·1		
20·9	−8·1	68·8		
21·4		70·5		

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

App. Alt.	OCT.—MAR. SUN Lower Limb	OCT.—MAR. SUN Upper Limb	APR.—SEPT. SUN Lower Limb	APR.—SEPT. SUN Upper Limb	STARS PLANETS
° ′	′	′	′	′	′
0 00	−17·5	−49·8	−17·8	−49·6	−33·8
0 03	16·9	49·2	17·2	49·0	33·2
0 06	16·3	48·6	16·6	48·4	32·6
0 09	15·7	48·0	16·0	47·8	32·0
0 12	15·2	47·5	15·4	47·2	31·5
0 15	14·6	46·9	14·8	46·6	30·9
0 18	−14·1	−46·4	−14·3	−46·1	−30·4
0 21	13·5	45·8	13·8	45·6	29·8
0 24	13·0	45·3	13·3	45·1	29·3
0 27	12·5	44·8	12·8	44·6	28·8
0 30	12·0	44·3	12·3	44·1	28·3
0 33	11·6	43·9	11·8	43·6	27·9
0 36	−11·1	−43·4	−11·3	−43·1	−27·4
0 39	10·6	42·9	10·9	42·7	26·9
0 42	10·2	42·5	10·5	42·3	26·5
0 45	9·8	42·1	10·0	41·8	26·1
0 48	9·4	41·7	9·6	41·4	25·7
0 51	9·0	41·3	9·2	41·0	25·3
0 54	− 8·6	−40·9	− 8·8	−40·6	−24·9
0 57	8·2	40·5	8·4	40·2	24·5
1 00	7·8	40·1	8·0	39·8	24·1
1 03	7·4	39·7	7·7	39·5	23·7
1 06	7·1	39·4	7·3	39·1	23·4
1 09	6·7	39·0	7·0	38·8	23·0
1 12	− 6·4	−38·7	− 6·6	−38·4	−22·7
1 15	6·0	38·3	6·3	38·1	22·3
1 18	5·7	38·0	6·0	37·8	22·0
1 21	5·4	37·7	5·7	37·5	21·7
1 24	5·1	37·4	5·3	37·1	21·4
1 27	4·8	37·1	5·0	36·8	21·1
1 30	− 4·5	−36·8	− 4·7	−36·5	−20·8
1 35	4·0	36·3	4·3	36·1	20·3
1 40	3·6	35·9	3·8	35·6	19·9
1 45	3·1	35·4	3·4	35·2	19·4
1 50	2·7	35·0	2·9	34·7	19·0
1 55	2·3	34·6	2·5	34·3	18·6
2 00	− 1·9	−34·2	− 2·1	−33·9	−18·2
2 05	1·5	33·8	1·7	33·5	17·8
2 10	1·1	33·4	1·4	33·2	17·4
2 15	0·8	33·1	1·0	32·8	17·1
2 20	0·4	32·7	0·7	32·5	16·7
2 25	− 0·1	32·4	− 0·3	32·1	16·4
2 30	+ 0·2	−32·1	0·0	−31·8	−16·1
2 35	0·5	31·8	+ 0·3	31·5	15·8
2 40	0·8	31·5	0·6	31·2	15·4
2 45	1·1	31·2	0·9	30·9	15·2
2 50	1·4	30·9	1·2	30·6	14·9
2 55	1·7	30·6	1·4	30·4	14·6
3 00	+ 2·0	−30·3	+ 1·7	−30·1	−14·3
3 05	2·2	30·1	2·0	29·8	14·1
3 10	2·5	29·8	2·2	29·6	13·8
3 15	2·7	29·6	2·5	29·3	13·6
3 20	2·9	29·4	2·7	29·1	13·4
3 25	3·2	29·1	2·9	28·9	13·1
3 30	+ 3·4	−28·9	+ 3·1	−28·7	−12·9

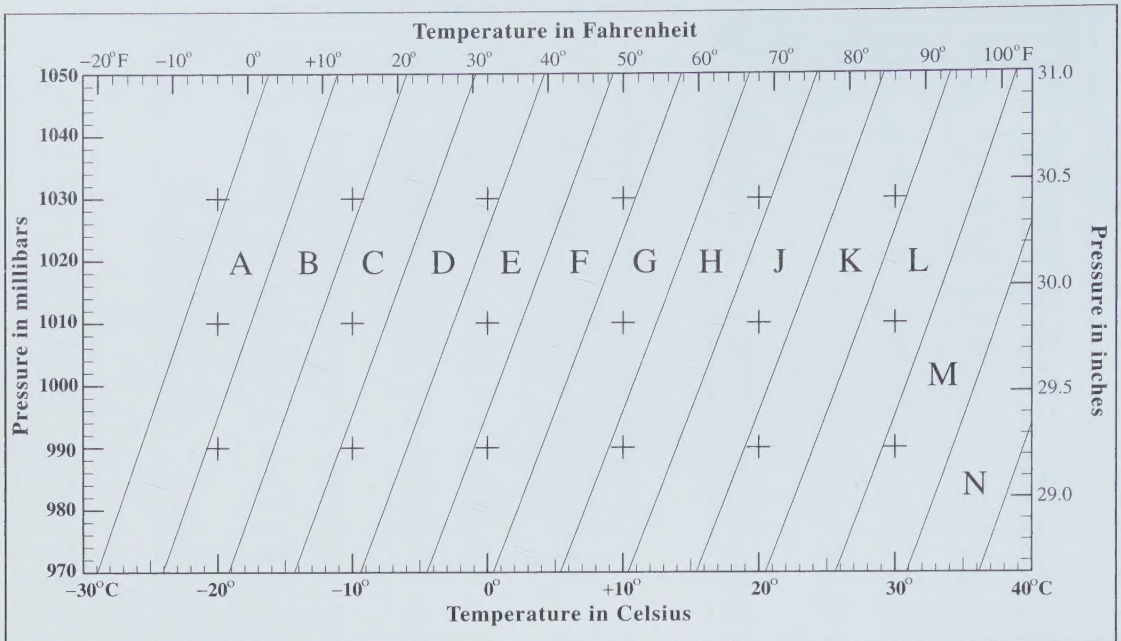
App. Alt.	OCT.—MAR. SUN Lower Limb	OCT.—MAR. SUN Upper Limb	APR.—SEPT. SUN Lower Limb	APR.—SEPT. SUN Upper Limb	STARS PLANETS
° ′	′	′	′	′	′
3 30	+ 3·4	−28·9	+ 3·1	−28·7	−12·9
3 35	3·6	28·7	3·3	28·5	12·7
3 40	3·8	28·5	3·6	28·2	12·5
3 45	4·0	28·3	3·8	28·0	12·3
3 50	4·2	28·1	4·0	27·8	12·1
3 55	4·4	27·9	4·1	27·7	11·9
4 00	+ 4·6	−27·7	+ 4·3	−27·5	−11·7
4 05	4·8	27·5	4·5	27·3	11·5
4 10	4·9	27·4	4·7	27·1	11·4
4 15	5·1	27·2	4·9	26·9	11·2
4 20	5·3	27·0	5·0	26·8	11·0
4 25	5·4	26·9	5·2	26·6	10·9
4 30	+ 5·6	−26·7	+ 5·3	−26·5	−10·7
4 35	5·7	26·6	5·5	26·3	10·6
4 40	5·9	26·4	5·6	26·2	10·4
4 45	6·0	26·3	5·8	26·0	10·3
4 50	6·2	26·1	5·9	25·9	10·1
4 55	6·3	26·0	6·1	25·7	10·0
5 00	+ 6·4	−25·9	+ 6·2	−25·6	− 9·8
5 05	6·6	25·7	6·3	25·5	9·7
5 10	6·7	25·6	6·5	25·3	9·6
5 15	6·8	25·5	6·6	25·2	9·5
5 20	7·0	25·3	6·7	25·1	9·3
5 25	7·1	25·2	6·8	25·0	9·2
5 30	+ 7·2	−25·1	+ 6·9	−24·9	− 9·1
5 35	7·3	25·0	7·1	24·7	9·0
5 40	7·4	24·9	7·2	24·6	8·9
5 45	7·5	24·8	7·3	24·5	8·8
5 50	7·6	24·7	7·4	24·4	8·7
5 55	7·7	24·6	7·5	24·3	8·6
6 00	+ 7·8	−24·5	+ 7·6	−24·2	− 8·5
6 10	8·0	24·3	7·8	24·0	8·3
6 20	8·2	24·1	8·0	23·8	8·1
6 30	8·4	23·9	8·2	23·6	7·9
6 40	8·6	23·7	8·3	23·5	7·7
6 50	8·7	23·6	8·5	23·3	7·6
7 00	+ 8·9	−23·4	+ 8·7	−23·1	− 7·4
7 10	9·1	23·2	8·8	23·0	7·2
7 20	9·2	23·1	9·0	22·8	7·1
7 30	9·3	23·0	9·1	22·7	6·9
7 40	9·5	22·8	9·2	22·6	6·8
7 50	9·6	22·7	9·4	22·4	6·7
8 00	+ 9·7	−22·6	+ 9·5	−22·3	− 6·6
8 10	9·9	22·4	9·6	22·2	6·4
8 20	10·0	22·3	9·7	22·1	6·3
8 30	10·1	22·2	9·9	21·9	6·2
8 40	10·2	22·1	10·0	21·8	6·1
8 50	10·3	22·0	10·1	21·7	6·0
9 00	+10·4	−21·9	+10·2	−21·6	− 5·9
9 10	10·5	21·8	10·3	21·5	5·8
9 20	10·6	21·7	10·4	21·4	5·7
9 30	10·7	21·6	10·5	21·3	5·6
9 40	10·8	21·5	10·6	21·2	5·5
9 50	10·9	21·4	10·6	21·2	5·4
10 00	+11·0	−21·3	+10·7	−21·1	− 5·3

Additional corrections for temperature and pressure are given on the following page.

For bubble sextant observations ignore dip and use the star corrections for Sun, planets and stars.

A4 ALTITUDE CORRECTION TABLES—ADDITIONAL CORRECTIONS

ADDITIONAL REFRACTION CORRECTIONS FOR NON-STANDARD CONDITIONS



App. Alt.	A	B	C	D	E	F	G	H	J	K	L	M	N	P	App. Alt.
° ′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	° ′
00 00	−7·3	−5·9	−4·6	−3·4	−2·2	−1·1	0·0	+1·0	+2·0	+3·0	+4·0	+4·9	+5·9	+6·9	00 00
00 30	5·5	4·5	3·5	2·6	1·7	0·8	0·0	0·8	1·6	2·3	3·1	3·8	4·5	5·3	00 30
01 00	4·4	3·5	2·8	2·0	1·3	0·7	0·0	0·6	1·2	1·8	2·4	3·0	3·6	4·2	01 00
01 30	3·5	2·9	2·2	1·7	1·1	0·5	0·0	0·5	1·0	1·5	2·0	2·5	2·9	3·4	01 30
02 00	2·9	2·4	1·9	1·4	0·9	0·4	0·0	0·4	0·8	1·3	1·7	2·0	2·4	2·8	02 00
02 30	−2·5	−2·0	−1·6	−1·2	−0·8	−0·4	0·0	+0·4	+0·7	+1·1	+1·4	+1·7	+2·1	+2·4	02 30
03 00	2·1	1·7	1·4	1·0	0·7	0·3	0·0	0·3	0·6	0·9	1·2	1·5	1·8	2·1	03 00
03 30	1·9	1·5	1·2	0·9	0·6	0·3	0·0	0·3	0·5	0·8	1·1	1·3	1·6	1·8	03 30
04 00	1·6	1·3	1·1	0·8	0·5	0·3	0·0	0·2	0·5	0·7	0·9	1·2	1·4	1·6	04 00
04 30	1·5	1·2	0·9	0·7	0·5	0·2	0·0	0·2	0·4	0·6	0·8	1·0	1·3	1·5	04 30
05 00	−1·3	−1·1	−0·9	−0·6	−0·4	−0·2	0·0	+0·2	+0·4	+0·6	+0·8	+0·9	+1·1	+1·3	05 00
06	1·1	0·9	0·7	0·5	0·3	0·2	0·0	0·2	0·3	0·5	0·6	0·8	0·9	1·1	06
07	1·0	0·8	0·6	0·5	0·3	0·1	0·0	0·1	0·3	0·4	0·5	0·7	0·8	0·9	07
08	0·8	0·7	0·5	0·4	0·3	0·1	0·0	0·1	0·2	0·4	0·5	0·6	0·7	0·8	08
09	0·7	0·6	0·5	0·4	0·2	0·1	0·0	0·1	0·2	0·3	0·4	0·5	0·6	0·7	09
10 00	−0·7	−0·5	−0·4	−0·3	−0·2	−0·1	0·0	+0·1	+0·2	+0·3	+0·4	+0·5	+0·6	+0·7	10 00
12	0·6	0·5	0·4	0·3	0·2	0·1	0·0	0·1	0·2	0·2	0·3	0·4	0·5	0·5	12
14	0·5	0·4	0·3	0·2	0·1	0·1	0·0	0·1	0·1	0·2	0·3	0·3	0·4	0·5	14
16	0·4	0·3	0·3	0·2	0·1	0·1	0·0	0·1	0·1	0·2	0·2	0·3	0·3	0·4	16
18	0·4	0·3	0·2	0·2	0·1	−0·1	0·0	+0·1	0·1	0·2	0·2	0·3	0·3	0·4	18
20 00	−0·3	−0·3	−0·2	−0·2	−0·1	0·0	0·0	0·0	+0·1	+0·1	+0·2	+0·2	+0·3	+0·3	20 00
25	0·3	0·2	0·2	0·1	0·1	0·0	0·0	0·0	0·1	0·1	0·1	0·2	0·2	0·2	25
30	0·2	0·2	0·1	0·1	0·1	0·0	0·0	0·0	+0·1	0·1	0·1	0·1	0·2	0·2	30
35	0·2	0·1	0·1	0·1	−0·1	0·0	0·0	0·0	0·0	0·1	0·1	0·1	0·1	0·2	35
40	0·1	0·1	0·1	−0·1	0·0	0·0	0·0	0·0	0·0	+0·1	0·1	0·1	0·1	0·1	40
50 00	−0·1	−0·1	−0·1	0·0	0·0	0·0	0·0	0·0	0·0	0·0	+0·1	+0·1	+0·1	+0·1	50 00

The graph is entered with arguments temperature and pressure to find a zone letter; using as arguments this zone letter and apparent altitude (sextant altitude corrected for index error and dip), a correction is taken from the table. This correction is to be applied to the sextant altitude in addition to the corrections for standard conditions (for the Sun, stars and planets from page A2-A3 and for the Moon from pages xxxiv and xxxv).

THE NAUTICAL ALMANAC

FOR THE YEAR

2011

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THE UNITED KINGDOM HYDROGRAPHIC OFFICE

2010

UNITED KINGDOM

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NOTE

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PREFACE

The British and American editions of *The Nautical Almanac*, which are identical in content, are produced jointly by H. M. Nautical Almanac Office, part of the United Kingdom Hydrographic Office, under the supervision of S. A. Bell and C. Y. Hohenkerk, and by the Nautical Almanac Office, United States Naval Observatory, under the supervision of S. E. Urban and M. T. Stollberg, to the general requirements of the Royal Navy and of the United States Navy. The Almanac is printed separately in the United Kingdom and in the United States of America.

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December 2009

RELIGIOUS CALENDARS

Epiphany	Jan. 6	Low Sunday	May 1
Septuagesima Sunday	Feb. 20	Rogation Sunday	May 29
Quinquagesima Sunday	Mar. 6	Ascension Day—Holy Thursday	June 2
Ash Wednesday	Mar. 9	Whit Sunday—Pentecost	June 12
Quadragesima Sunday	Mar. 13	Trinity Sunday	June 19
Palm Sunday	Apr. 17	Corpus Christi	June 23
Good Friday	Apr. 22	First Sunday in Advent	Nov. 27
Easter Day	Apr. 24	Christmas Day (Sunday)	Dec. 25
First Day of Passover (Pesach)	Apr. 19	Day of Atonement (Yom Kippur)	Oct. 8
Feast of Weeks (Shavuot)	June 8	First day of Tabernacles (Succoth)	Oct. 13
Jewish New Year 5772 (Rosh Hashanah)	Sept. 29		
Ramadân, First day of (tabular)	Aug. 1	Islamic New Year (1433)	Nov. 27

The Jewish and Islamic dates above are tabular dates, which begin at sunset on the previous evening and end at sunset on the date tabulated. In practice, the dates of Islamic fasts and festivals are determined by an actual sighting of the appropriate new moon.

CIVIL CALENDAR—UNITED KINGDOM

Accession of Queen Elizabeth II	Feb. 6	Birthday of Prince Philip, Duke of Edinburgh	June 10
St David (Wales)	Mar. 1	The Queen's Official Birthday†	June 11
Commonwealth Day	Mar. 14	Remembrance Sunday	Nov. 13
St Patrick (Ireland)	Mar. 17	Birthday of the Prince of Wales	Nov. 14
Birthday of Queen Elizabeth II	Apr. 21	St Andrew (Scotland)	Nov. 30
St George (England)	Apr. 23		
Coronation Day	June 2		

PUBLIC HOLIDAYS

England and Wales—Jan. 3†, Apr. 22, Apr. 25, May 2†, May 30, Aug. 29, Dec. 26, Dec. 27†
Northern Ireland—Jan. 3†, Mar. 17, Apr. 22, Apr. 25, May 2†, May 30, July 12, Aug. 29, Dec. 26, Dec. 27†
Scotland—Jan. 3†, Jan. 4†, Apr. 22, May 2, May 30†, Aug. 1, Dec. 26, Dec. 27

CIVIL CALENDAR—UNITED STATES OF AMERICA

New Year's Day	Jan. 1	Labor Day	Sept. 5
Martin Luther King's Birthday	Jan. 17	Columbus Day	Oct. 10
Washington's Birthday	Feb. 21	Election Day (in certain States)	Nov. 8
Memorial Day	May 30	Veterans Day	Nov. 11
Independence Day	July 4	Thanksgiving Day	Nov. 24

†Dates subject to confirmation

PHASES OF THE MOON

New Moon		First Quarter		Full Moon		Last Quarter	
	d h m		d h m		d h m		d h m
Jan.	4 09 03	Jan.	12 11 31	Jan.	19 21 21	Jan.	26 12 57
Feb.	3 02 31	Feb.	11 07 18	Feb.	18 08 36	Feb.	24 23 26
Mar.	4 20 46	Mar.	12 23 45	Mar.	19 18 10	Mar.	26 12 07
Apr.	3 14 32	Apr.	11 12 05	Apr.	18 02 44	Apr.	25 02 47
May	3 06 51	May	10 20 33	May	17 11 09	May	24 18 52
June	1 21 03	June	9 02 11	June	15 20 14	June	23 11 48
July	1 08 54	July	8 06 29	July	15 06 40	July	23 05 02
July	30 18 40	Aug.	6 11 08	Aug.	13 18 57	Aug.	21 21 54
Aug.	29 03 04	Sept.	4 17 39	Sept.	12 09 27	Sept.	20 13 39
Sept.	27 11 09	Oct.	4 03 15	Oct.	12 02 06	Oct.	20 03 30
Oct.	26 19 56	Nov.	2 16 38	Nov.	10 20 16	Nov.	18 15 09
Nov.	25 06 10	Dec.	2 09 52	Dec.	10 14 36	Dec.	18 00 48
Dec.	24 18 06						

DAYS OF THE WEEK AND DAYS OF THE YEAR

	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
Day	Wk Yr	Wk Yr	Wk Yr	Wk Yr	Wk Yr	Wk Yr	Wk Yr	Wk Yr	Wk Yr	Wk Yr	Wk Yr	Wk Yr
1	Sa. 1	Tu. 32	Tu. 60	F. 91	Su. 121	W. 152	F. 182	M. 213	Th. 244	Sa. 274	Tu. 305	Th. 335
2	Su. 2	W. 33	W. 61	Sa. 92	M. 122	Th. 153	Sa. 183	Tu. 214	F. 245	Su. 275	W. 306	F. 336
3	M. 3	Th. 34	Th. 62	Su. 93	Tu. 123	F. 154	Su. 184	W. 215	Sa. 246	M. 276	Th. 307	Sa. 337
4	Tu. 4	F. 35	F. 63	M. 94	W. 124	Sa. 155	M. 185	Th. 216	Su. 247	Tu. 277	F. 308	Su. 338
5	W. 5	Sa. 36	Sa. 64	Tu. 95	Th. 125	Su. 156	Tu. 186	F. 217	M. 248	W. 278	Sa. 309	M. 339
6	Th. 6	Su. 37	Su. 65	W. 96	F. 126	M. 157	W. 187	Sa. 218	Tu. 249	Th. 279	Su. 310	Tu. 340
7	F. 7	M. 38	M. 66	Th. 97	Sa. 127	Tu. 158	Th. 188	Su. 219	W. 250	F. 280	M. 311	W. 341
8	Sa. 8	Tu. 39	Tu. 67	F. 98	Su. 128	W. 159	F. 189	M. 220	Th. 251	Sa. 281	Tu. 312	Th. 342
9	Su. 9	W. 40	W. 68	Sa. 99	M. 129	Th. 160	Sa. 190	Tu. 221	F. 252	Su. 282	W. 313	F. 343
10	M. 10	Th. 41	Th. 69	Su. 100	Tu. 130	F. 161	Su. 191	W. 222	Sa. 253	M. 283	Th. 314	Sa. 344
11	Tu. 11	F. 42	F. 70	M. 101	W. 131	Sa. 162	M. 192	Th. 223	Su. 254	Tu. 284	F. 315	Su. 345
12	W. 12	Sa. 43	Sa. 71	Tu. 102	Th. 132	Su. 163	Tu. 193	F. 224	M. 255	W. 285	Sa. 316	M. 346
13	Th. 13	Su. 44	Su. 72	W. 103	F. 133	M. 164	W. 194	Sa. 225	Tu. 256	Th. 286	Su. 317	Tu. 347
14	F. 14	M. 45	M. 73	Th. 104	Sa. 134	Tu. 165	Th. 195	Su. 226	W. 257	F. 287	M. 318	W. 348
15	Sa. 15	Tu. 46	Tu. 74	F. 105	Su. 135	W. 166	F. 196	M. 227	Th. 258	Sa. 288	Tu. 319	Th. 349
16	Su. 16	W. 47	W. 75	Sa. 106	M. 136	Th. 167	Sa. 197	Tu. 228	F. 259	Su. 289	W. 320	F. 350
17	M. 17	Th. 48	Th. 76	Su. 107	Tu. 137	F. 168	Su. 198	W. 229	Sa. 260	M. 290	Th. 321	Sa. 351
18	Tu. 18	F. 49	F. 77	M. 108	W. 138	Sa. 169	M. 199	Th. 230	Su. 261	Tu. 291	F. 322	Su. 352
19	W. 19	Sa. 50	Sa. 78	Tu. 109	Th. 139	Su. 170	Tu. 200	F. 231	M. 262	W. 292	Sa. 323	M. 353
20	Th. 20	Su. 51	Su. 79	W. 110	F. 140	M. 171	W. 201	Sa. 232	Tu. 263	Th. 293	Su. 324	Tu. 354
21	F. 21	M. 52	M. 80	Th. 111	Sa. 141	Tu. 172	Th. 202	Su. 233	W. 264	F. 294	M. 325	W. 355
22	Sa. 22	Tu. 53	Tu. 81	F. 112	Su. 142	W. 173	F. 203	M. 234	Th. 265	Sa. 295	Tu. 326	Th. 356
23	Su. 23	W. 54	W. 82	Sa. 113	M. 143	Th. 174	Sa. 204	Tu. 235	F. 266	Su. 296	W. 327	F. 357
24	M. 24	Th. 55	Th. 83	Su. 114	Tu. 144	F. 175	Su. 205	W. 236	Sa. 267	M. 297	Th. 328	Sa. 358
25	Tu. 25	F. 56	F. 84	M. 115	W. 145	Sa. 176	M. 206	Th. 237	Su. 268	Tu. 298	F. 329	Su. 359
26	W. 26	Sa. 57	Sa. 85	Tu. 116	Th. 146	Su. 177	Tu. 207	F. 238	M. 269	W. 299	Sa. 330	M. 360
27	Th. 27	Su. 58	Su. 86	W. 117	F. 147	M. 178	W. 208	Sa. 239	Tu. 270	Th. 300	Su. 331	Tu. 361
28	F. 28	M. 59	M. 87	Th. 118	Sa. 148	Tu. 179	Th. 209	Su. 240	W. 271	F. 301	M. 332	W. 362
29	Sa. 29		Tu. 88	F. 119	Su. 149	W. 180	F. 210	M. 241	Th. 272	Sa. 302	Tu. 333	Th. 363
30	Su. 30		W. 89	Sa. 120	M. 150	Th. 181	Sa. 211	Tu. 242	F. 273	Su. 303	W. 334	F. 364
31	M. 31		Th. 90		Tu. 151		Su. 212	W. 243		M. 304		Sa. 365

ECLIPSES

There are four eclipses of the Sun and two of the Moon.

1. *A partial eclipse of the Sun,* January 4. See map on page 6. Most of Europe, the northern half of Africa, the Middle East, western Asia, north-west China, western Mongolia and the north-west part of India.

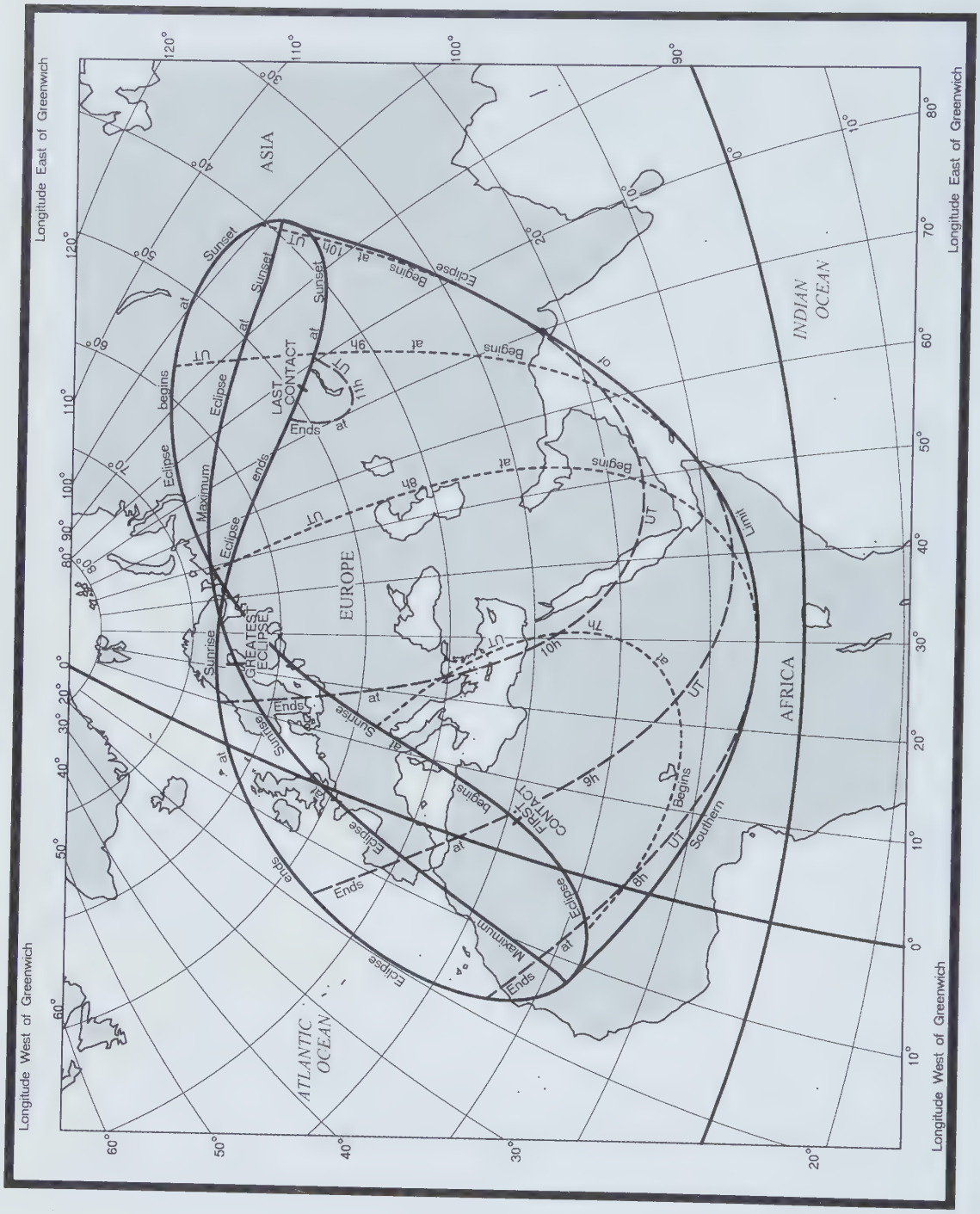
2. *A partial eclipse of the Sun,* June 1. See map on page 7. Eastern Asia except southern Japan, northern Alaska, northern Canada, the northern tip of Scandinavia, Greenland and Iceland.

3. *A total eclipse of the Moon,* June 15. Australasia, southern Japan, Asia except the northern part, India, Africa, Europe and the eastern part of South America.

4. *A partial eclipse of the Sun,* July 1. Southern Ocean south of Africa.

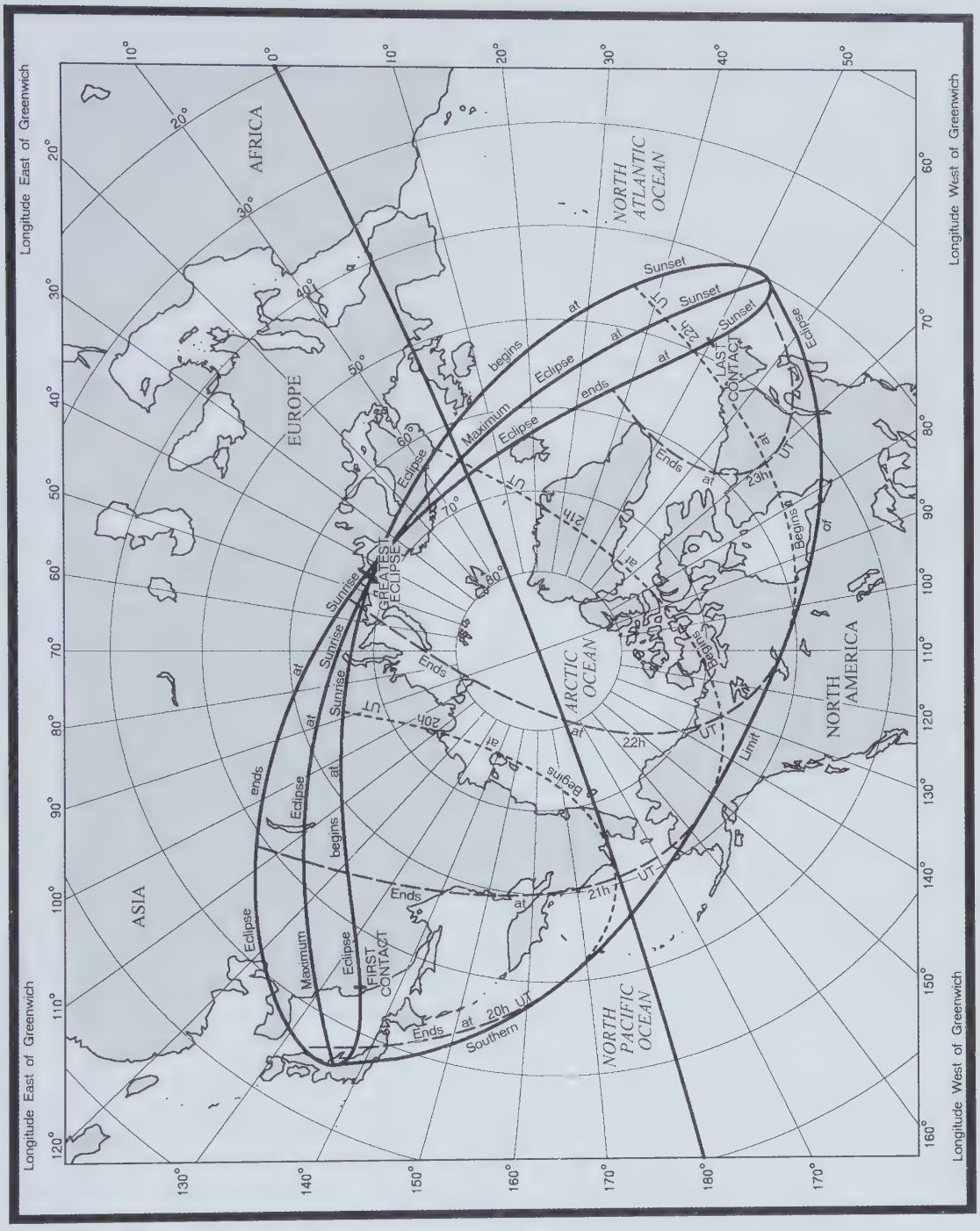
5. *A partial eclipse of the Sun,* November 25. Southern tip of South Africa, Antarctica, Tasmania and New Zealand.

6. *A total eclipse of the Moon,* December 10. North America except the eastern part, the Hawaiian Islands, Oceania, Australasia, Asia, eastern Africa, eastern Europe and Iceland.



SOLAR ECLIPSE DIAGRAMS

The principal features shown on the above diagrams are: the paths of total and annular eclipses; the northern and southern limits of partial eclipse; the sunrise and sunset curves; dashed lines which show the times of beginning and end of partial eclipse at hourly intervals.



SOLAR ECLIPSE DIAGRAMS

Further details of the paths and times of central eclipse are given in *The Astronomical Almanac*.

VISIBILITY OF PLANETS

VENUS is a brilliant object in the morning sky from the beginning of the year until near the end of the second week of July when it becomes too close to the Sun for observation. During the second half of September it reappears in the evening sky where it stays until the end of the year. Venus is in conjunction with Jupiter on May 11 and with Mars on May 22.

MARS is too close to the Sun for observation until mid-April when it appears in the morning sky in Pisces. Its westward elongation gradually increases as it passes through Aries, Taurus (passing 5° N of *Aldebaran* on July 6), Gemini (passing 6° S of *Pollux* on September 10), Cancer and into Leo (passing 1°.4 N of *Regulus* on November 10). Mars is in conjunction with Mercury on April 19 and May 20, with Jupiter on May 1 and with Venus on May 22.

JUPITER can be seen at the beginning of the year in the evening sky in Pisces, moves into Cetus in late February and back into Pisces in early March. From late March it becomes too close to the Sun for observation. It reappears in the morning sky in the second half of April and moves into Aries in early June. Its westward elongation gradually increases and from the beginning of August it can be seen for more than half the night. It is at opposition on October 29 when it is visible throughout the night. Its eastward elongation gradually decreases and at the end of the first week of December it passes once more into Pisces. Jupiter is in conjunction with Mercury on March 16 and May 10, with Mars on May 1 and with Venus on May 11.

SATURN rises shortly after midnight at the beginning of the year in Virgo and remains in this constellation throughout the year (passing 5° N of *Spica* on October 31). Saturn is at opposition on April 4 when it can be seen throughout the night, and from early July until late September it is visible only in the evening sky. It then becomes too close to the Sun for observation until the end of October, after which it can be seen in the morning sky for the rest of the year.

MERCURY can only be seen low in the east before sunrise, or low in the west after sunset (about the time of beginning or end of civil twilight). It is visible in the mornings between the following approximate dates: January 1 (+0·1) to February 13 (−0·8), April 18 (+3·1) to June 5 (−1·3), August 25 (+2·2) to September 19 (−1·3) and December 10 (+1·7) to December 31 (−0·4); the planet is brighter at the end of each period. It is visible in the evenings between the following approximate dates: March 7 (−1·4) to April 2 (+2·5), June 20 (−1·4) to August 9 (+2·8) and October 12 (−0·7) to November 28 (+1·5); the planet is brighter at the beginning of each period. The figures in parentheses are the magnitudes.

PLANET DIAGRAM

General Description. The diagram on the opposite page shows, in graphical form for any date during the year, the local mean time of meridian passage of the Sun, of the five planets Mercury, Venus, Mars, Jupiter, and Saturn, and of each 30° of SHA; intermediate lines corresponding to particular stars, may be drawn in by the user if desired. It is intended to provide a general picture of the availability of planets and stars for observation.

On each side of the line marking the time of meridian passage of the Sun a band, 45^m wide, is shaded to indicate that planets and most stars crossing the meridian within 45^m of the Sun are too close to the Sun for observation.

Method of use and interpretation. For any date the diagram provides immediately the local mean times of meridian passage of the Sun, planets and stars, and thus the following information:

(a) whether a planet or star is too close to the Sun for observation;

(b) some indication of its position in the sky, especially during twilight;

(c) the proximity of other planets.

When the meridian passage of an outer planet occurs at midnight the body is in opposition to the Sun and is visible all night; a planet may then be observable during both morning and evening twilights. As the time of meridian passage decreases, the body eventually ceases to be observable in the morning, but its altitude above the eastern horizon at sunset gradually increases; this continues until the body is on the meridian during evening twilight. From then onwards the body is observable above the western horizon and its altitude at sunset gradually decreases; eventually the body becomes too close to the Sun for observation. When the body again becomes visible it is seen low in the east during morning twilight; its altitude at sunrise increases until meridian passage occurs during morning twilight. Then, as the time of meridian passage decreases to 0^h, the body is observable in the west during morning twilight with a gradually decreasing altitude, until it once again reaches opposition.

DO NOT CONFUSE

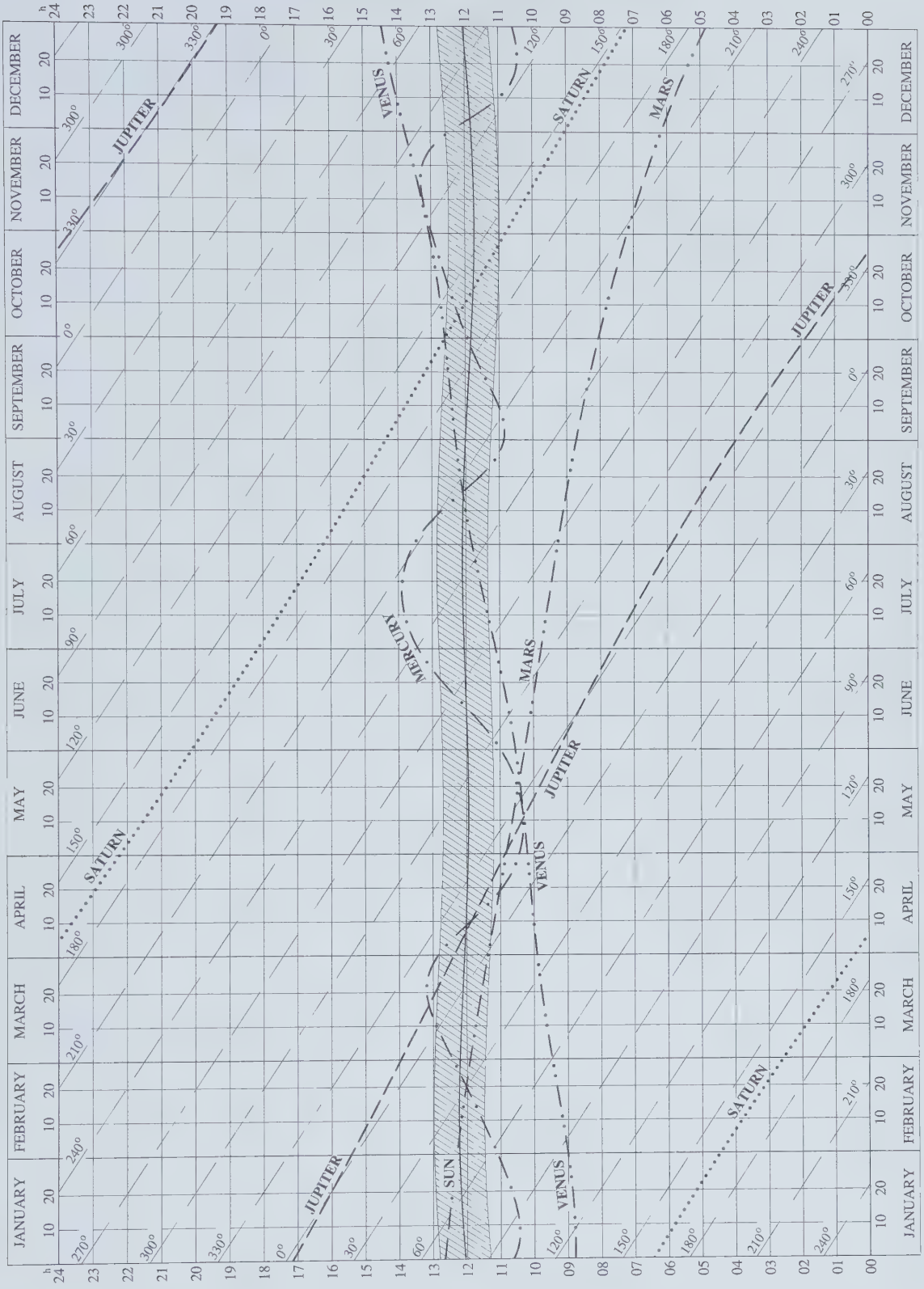
Jupiter with Mercury in mid-March and in the first half of May and with Mars in late April to early May; on all occasions Jupiter is the brighter object.

Mercury with Mars in the second half of April when Mars is the brighter object.

Venus with Mercury from late April to late May and mid-October to late November, with Jupiter in the first half of May, with Mars from mid-May to early June and with Saturn in late September; on all occasions Venus is the brighter object.

Mercury with Mars in mid-May when Mercury is the brighter object.

LOCAL MEAN TIME OF MERIDIAN PASSAGE



UT	ARIES	VENUS −4.6		MARS +1.2		JUPITER −2.3		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1 00	100 18.2	228 13.1	S15 16.5	170 15.5	S23 09.6	102 57.9	S 2 32.0	264 01.4	S 4 19.4
01	115 20.7	243 13.2	17.1	185 15.9	09.3	118 00.0	31.8	279 03.8	19.4
02	130 23.1	258 13.2	17.7	200 16.3	09.0	133 02.2	31.7	294 06.1	19.4
03	145 25.6	273 13.3	18.2	215 16.6	08.8	148 04.3	31.6	309 08.5	19.5
04	160 28.1	288 13.3	18.8	230 17.0	08.5	163 06.5	31.4	324 10.9	19.5
05	175 30.5	303 13.4	19.3	245 17.4	08.3	178 08.7	31.3	339 13.2	19.5
06	190 33.0	318 13.4	S15 19.9	260 17.8	S23 08.0	193 10.8	S 2 31.1	354 15.6	S 4 19.6
07	205 35.5	333 13.4	20.5	275 18.2	07.8	208 13.0	31.0	9 17.9	19.6
S 08	220 37.9	348 13.5	21.0	290 18.5	07.5	223 15.1	30.8	24 20.3	19.6
A 09	235 40.4	3 13.5	21.6	305 18.9	07.3	238 17.3	30.7	39 22.7	19.7
T 10	250 42.8	18 13.6	22.2	320 19.3	07.0	253 19.5	30.6	54 25.0	19.7
U 11	265 45.3	33 13.6	22.7	335 19.7	06.7	268 21.6	30.4	69 27.4	19.7
R 12	280 47.8	48 13.6	S15 23.3	350 20.1	S23 06.5	283 23.8	S 2 30.3	84 29.7	S 4 19.8
D 13	295 50.2	63 13.7	23.8	5 20.4	06.2	298 25.9	30.1	99 32.1	19.8
A 14	310 52.7	78 13.7	24.4	20 20.8	06.0	313 28.1	30.0	114 34.4	19.8
Y 15	325 55.2	93 13.7	25.0	35 21.2	05.7	328 30.2	29.8	129 36.8	19.9
16	340 57.6	108 13.8	25.5	50 21.6	05.4	343 32.4	29.7	144 39.2	19.9
17	356 00.1	123 13.8	26.1	65 21.9	05.2	358 34.6	29.6	159 41.5	19.9
18	11 02.6	138 13.8	S15 26.7	80 22.3	S23 04.9	13 36.7	S 2 29.4	174 43.9	S 4 19.9
19	26 05.0	153 13.9	27.2	95 22.7	04.7	28 38.9	29.3	189 46.2	20.0
20	41 07.5	168 13.9	27.8	110 23.1	04.4	43 41.0	29.1	204 48.6	20.0
21	56 10.0	183 13.9	28.3	125 23.5	04.1	58 43.2	29.0	219 51.0	20.0
22	71 12.4	198 14.0	28.9	140 23.8	03.9	73 45.3	28.8	234 53.3	20.1
23	86 14.9	213 14.0	29.5	155 24.2	03.6	88 47.5	28.7	249 55.7	20.1
2 00	101 17.3	228 14.0	S15 30.0	170 24.6	S23 03.3	103 49.6	S 2 28.6	264 58.1	S 4 20.1
01	116 19.8	243 14.0	30.6	185 25.0	03.1	118 51.8	28.4	280 00.4	20.2
02	131 22.3	258 14.0	31.2	200 25.4	02.8	133 54.0	28.3	295 02.8	20.2
03	146 24.7	273 14.1	31.7	215 25.7	02.6	148 56.1	28.1	310 05.1	20.2
04	161 27.2	288 14.1	32.3	230 26.1	02.3	163 58.3	28.0	325 07.5	20.2
05	176 29.7	303 14.1	32.9	245 26.5	02.0	179 00.4	27.8	340 09.9	20.3
06	191 32.1	318 14.1	S15 33.4	260 26.9	S23 01.8	194 02.6	S 2 27.7	355 12.2	S 4 20.3
07	206 34.6	333 14.1	34.0	275 27.3	01.5	209 04.7	27.5	10 14.6	20.3
08	221 37.1	348 14.2	34.5	290 27.6	01.2	224 06.9	27.4	25 16.9	20.4
S 09	236 39.5	3 14.2	35.1	305 28.0	01.0	239 09.0	27.2	40 19.3	20.4
U 10	251 42.0	18 14.2	35.7	320 28.4	00.7	254 11.2	27.1	55 21.7	20.4
N 11	266 44.4	33 14.2	36.2	335 28.8	00.4	269 13.3	27.0	70 24.0	20.5
D 12	281 46.9	48 14.2	S15 36.8	350 29.2	S23 00.1	284 15.5	S 2 26.8	85 26.4	S 4 20.5
A 13	296 49.4	63 14.2	37.3	5 29.5	22 59.9	299 17.6	26.7	100 28.8	20.5
Y 14	311 51.8	78 14.2	37.9	20 29.9	59.6	314 19.8	26.5	115 31.1	20.5
15	326 54.3	93 14.2	38.5	35 30.3	59.3	329 21.9	26.4	130 33.5	20.6
16	341 56.8	108 14.2	39.0	50 30.7	59.1	344 24.1	26.2	145 35.9	20.6
17	356 59.2	123 14.2	39.6	65 31.1	58.8	359 26.2	26.1	160 38.2	20.6
18	12 01.7	138 14.3	S15 40.2	80 31.5	S22 58.5	14 28.4	S 2 25.9	175 40.6	S 4 20.7
19	27 04.2	153 14.3	40.7	95 31.8	58.3	29 30.5	25.8	190 42.9	20.7
20	42 06.6	168 14.3	41.3	110 32.2	58.0	44 32.7	25.6	205 45.3	20.7
21	57 09.1	183 14.3	41.8	125 32.6	57.7	59 34.8	25.5	220 47.7	20.7
22	72 11.6	198 14.3	42.4	140 33.0	57.4	74 37.0	25.4	235 50.0	20.8
23	87 14.0	213 14.3	43.0	155 33.4	57.2	89 39.1	25.2	250 52.4	20.8
3 00	102 16.5	228 14.3	S15 43.5	170 33.7	S22 56.9	104 41.3	S 2 25.1	265 54.8	S 4 20.8
01	117 18.9	243 14.3	44.1	185 34.1	56.6	119 43.4	24.9	280 57.1	20.9
02	132 21.4	258 14.3	44.7	200 34.5	56.3	134 45.6	24.8	295 59.5	20.9
03	147 23.9	273 14.3	45.2	215 34.9	56.1	149 47.7	24.6	311 01.9	20.9
04	162 26.3	288 14.2	45.8	230 35.3	55.8	164 49.9	24.5	326 04.2	20.9
05	177 28.8	303 14.2	46.3	245 35.6	55.5	179 52.0	24.3	341 06.6	21.0
06	192 31.3	318 14.2	S15 46.9	260 36.0	S22 55.2	194 54.2	S 2 24.2	356 09.0	S 4 21.0
07	207 33.7	333 14.2	47.5	275 36.4	54.9	209 56.3	24.0	11 11.3	21.0
08	222 36.2	348 14.2	48.0	290 36.8	54.7	224 58.5	23.9	26 13.7	21.1
M 09	237 38.7	3 14.2	48.6	305 37.2	54.4	240 00.6	23.7	41 16.1	21.1
O 10	252 41.1	18 14.2	49.1	320 37.6	54.1	255 02.8	23.6	56 18.4	21.1
N 11	267 43.6	33 14.2	49.7	335 37.9	53.8	270 04.9	23.4	71 20.8	21.1
D 12	282 46.1	48 14.2	S15 50.3	350 38.3	S22 53.6	285 07.1	S 2 23.3	86 23.2	S 4 21.2
A 13	297 48.5	63 14.2	50.8	5 38.7	53.3	300 09.2	23.1	101 25.5	21.2
Y 14	312 51.0	78 14.1	51.4	20 39.1	53.0	315 11.3	23.0	116 27.9	21.2
15	327 53.4	93 14.1	51.9	35 39.5	52.7	330 13.5	22.9	131 30.3	21.3
16	342 55.9	108 14.1	52.5	50 39.9	52.4	345 15.6	22.7	146 32.6	21.3
17	357 58.4	123 14.1	53.1	65 40.2	52.1	0 17.8	22.6	161 35.0	21.3
18	13 00.8	138 14.1	S15 53.6	80 40.6	S22 51.9	15 19.9	S 2 22.4	176 37.4	S 4 21.3
19	28 03.3	153 14.1	54.2	95 41.0	51.6	30 22.1	22.3	191 39.7	21.4
20	43 05.8	168 14.0	54.7	110 41.4	51.3	45 24.2	22.1	206 42.1	21.4
21	58 08.2	183 14.0	55.3	125 41.8	51.0	60 26.4	22.0	221 44.5	21.4
22	73 10.7	198 14.0	55.9	140 42.2	50.7	75 28.5	21.8	236 46.8	21.4
23	88 13.2	213 14.0	56.4	155 42.5	50.4	90 30.6	21.7	251 49.2	21.5
	h m								
Mer. Pass.	17 12.0	*v* 0.0	*d* 0.6	*v* 0.4	*d* 0.3	*v* 2.2	*d* 0.1	*v* 2.4	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.8
Achernar	335 27.8	S57 11.1
Acrux	173 11.3	S63 09.4
Adhara	255 13.5	S28 59.3
Aldebaran	290 51.1	N16 31.9
Alioth	166 22.1	N55 53.6
Alkaid	153 00.3	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.6	S 8 42.5
Alphecca	126 12.7	N26 40.5
Alpheratz	357 45.4	N29 09.3
Altair	62 10.3	N 8 53.9
Ankaa	353 17.4	S42 14.9
Antares	112 28.7	S26 27.3
Arcturus	145 57.4	N19 07.3
Atria	107 32.7	S69 02.7
Avior	234 18.2	S59 32.7
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.5
Canopus	263 56.4	S52 42.2
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.4
Denebola	182 35.3	N14 30.4
Diphda	348 57.6	S17 55.6
Dubhe	193 53.4	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.5	N51 29.2
Enif	33 49.1	N 9 55.7
Fomalhaut	15 26.0	S29 33.9
Gacrux	172 02.9	S57 10.3
Gienah	175 54.1	S17 36.2
Hadar	148 50.7	S60 25.4
Hamal	328 02.6	N23 31.0
Kaus Aust.	83 46.5	S34 22.7
Kochab	137 20.4	N74 06.3
Markab	13 40.2	N15 16.0
Menkar	314 16.7	N 4 08.0
Menkent	148 09.8	S36 25.3
Miaplacidus	221 39.4	S69 45.7
Mirfak	308 42.6	N49 54.2
Nunki	76 00.9	S26 16.9
Peacock	53 22.5	S56 42.0
Pollux	243 29.5	N27 59.8
Procyon	245 01.2	N 5 11.7
Rasalhague	96 08.4	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.4	S 8 11.4
Rigil Kent.	139 54.5	S60 52.6
Sabik	102 14.9	S15 44.3
Schedar	349 42.6	N56 36.2
Shaula	96 24.7	S37 06.6
Sirius	258 34.9	S16 44.0
Spica	158 33.2	S11 13.2
Suhail	222 53.4	S43 28.6
Vega	80 40.6	N38 47.7
Zuben'ubi	137 07.6	S16 05.2

	SHA	Mer. Pass.
	° ′	h m
Venus	126 56.7	8 47
Mars	69 07.3	12 38
Jupiter	2 32.3	17 02
Saturn	163 40.7	6 19

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
1 00	179 12.1	S23 02.7	223 57.6	7.2	S22 50.4	4.8	57.8
01	194 11.8	02.5	238 23.8	7.1	22 55.2	4.7	57.8
02	209 11.5	02.3	252 49.9	7.1	22 59.9	4.6	57.8
03	224 11.2	. . 02.1	267 16.0	7.0	23 04.5	4.4	57.7
04	239 10.9	01.9	281 42.0	7.1	23 08.9	4.3	57.7
05	254 10.6	01.7	296 08.1	7.0	23 13.2	4.1	57.7
06	269 10.3	S23 01.5	310 34.1	7.0	S23 17.3	4.0	57.7
07	284 10.1	01.3	325 00.1	7.0	23 21.3	3.9	57.7
08	299 09.8	01.1	339 26.1	7.0	23 25.2	3.7	57.7
09	314 09.5	. . 00.9	353 52.1	7.0	23 28.9	3.5	57.6
10	329 09.2	00.7	8 18.1	6.9	23 32.4	3.5	57.6
11	344 08.9	00.5	22 44.0	7.0	23 35.9	3.2	57.6
12	359 08.6	S23 00.3	37 10.0	6.9	S23 39.1	3.2	57.6
13	14 08.3	23 00.1	51 35.9	6.9	23 42.3	2.9	57.6
14	29 08.0	22 59.9	66 01.8	7.0	23 45.2	2.9	57.5
15	44 07.7	. . 59.7	80 27.8	6.9	23 48.1	2.7	57.5
16	59 07.4	59.5	94 53.7	6.9	23 50.8	2.5	57.5
17	74 07.1	59.3	109 19.6	6.9	23 53.3	2.4	57.5
18	89 06.8	S22 59.1	123 45.5	6.9	S23 55.7	2.3	57.5
19	104 06.5	58.9	138 11.4	7.0	23 58.0	2.1	57.4
20	119 06.2	58.7	152 37.4	6.9	24 00.1	2.0	57.4
21	134 05.9	. . 58.5	167 03.3	6.9	24 02.1	1.8	57.4
22	149 05.6	58.2	181 29.2	6.9	24 03.9	1.7	57.4
23	164 05.3	58.0	195 55.1	7.0	24 05.6	1.5	57.4
2 00	179 05.0	S22 57.8	210 21.1	6.9	S24 07.1	1.4	57.4
01	194 04.7	57.6	224 47.0	7.0	24 08.5	1.3	57.3
02	209 04.4	57.4	239 13.0	6.9	24 09.8	1.1	57.3
03	224 04.1	. . 57.2	253 38.9	7.0	24 10.9	0.9	57.3
04	239 03.9	57.0	268 04.9	7.0	24 11.8	0.8	57.3
05	254 03.6	56.7	282 30.9	7.0	24 12.6	0.7	57.3
06	269 03.3	S22 56.5	296 56.9	7.0	S24 13.3	0.5	57.2
07	284 03.0	56.3	311 22.9	7.1	24 13.8	0.4	57.2
08	299 02.7	56.1	325 49.0	7.1	24 14.2	0.2	57.2
09	314 02.4	. . 55.9	340 15.1	7.0	24 14.4	0.1	57.2
10	329 02.1	55.6	354 41.1	7.2	24 14.5	0.1	57.2
11	344 01.8	55.4	9 07.3	7.1	24 14.4	0.2	57.1
12	359 01.5	S22 55.2	23 33.4	7.2	S24 14.2	0.3	57.1
13	14 01.2	55.0	37 59.6	7.1	24 13.9	0.5	57.1
14	29 00.9	54.7	52 25.7	7.3	24 13.4	0.7	57.1
15	44 00.6	. . 54.5	66 52.0	7.2	24 12.7	0.7	57.1
16	59 00.3	54.3	81 18.2	7.3	24 12.0	1.0	57.0
17	74 00.0	54.1	95 44.5	7.3	24 11.0	1.0	57.0
18	88 59.8	S22 53.8	110 10.8	7.4	S24 10.0	1.2	57.0
19	103 59.5	53.6	124 37.2	7.4	24 08.8	1.4	57.0
20	118 59.2	53.4	139 03.6	7.4	24 07.4	1.4	56.9
21	133 58.9	. . 53.1	153 30.0	7.4	24 06.0	1.7	56.9
22	148 58.6	52.9	167 56.4	7.5	24 04.3	1.7	56.9
23	163 58.3	52.7	182 22.9	7.6	24 02.6	1.9	56.9
3 00	178 58.0	S22 52.4	196 49.5	7.6	S24 00.7	2.0	56.9
01	193 57.7	52.2	211 16.1	7.6	23 58.7	2.2	56.8
02	208 57.4	52.0	225 42.7	7.7	23 56.5	2.3	56.8
03	223 57.1	. . 51.7	240 09.4	7.7	23 54.2	2.5	56.8
04	238 56.8	51.5	254 36.1	7.8	23 51.7	2.5	56.8
05	253 56.6	51.3	269 02.9	7.8	23 49.2	2.8	56.8
06	268 56.3	S22 51.0	283 29.7	7.9	S23 46.4	2.8	56.7
07	283 56.0	50.8	297 56.6	7.9	23 43.6	3.0	56.7
08	298 55.7	50.6	312 23.5	8.0	23 40.6	3.1	56.7
09	313 55.4	. . 50.3	326 50.5	8.0	23 37.5	3.3	56.7
10	328 55.1	50.1	341 17.5	8.1	23 34.2	3.3	56.7
11	343 54.8	49.8	355 44.6	8.2	23 30.9	3.5	56.6
12	358 54.5	S22 49.6	10 11.8	8.2	S23 27.4	3.7	56.6
13	13 54.2	49.3	24 39.0	8.2	23 23.7	3.8	56.6
14	28 54.0	49.1	39 06.2	8.4	23 19.9	3.8	56.6
15	43 53.7	. . 48.9	53 33.6	8.3	23 16.1	4.1	56.5
16	58 53.4	48.6	68 00.9	8.5	23 12.0	4.1	56.5
17	73 53.1	48.4	82 28.4	8.5	23 07.9	4.3	56.5
18	88 52.8	S22 48.1	96 55.9	8.6	S23 03.6	4.4	56.5
19	103 52.5	47.9	111 23.5	8.6	22 59.2	4.5	56.5
20	118 52.2	47.6	125 51.1	8.7	22 54.7	4.7	56.4
21	133 51.9	. . 47.4	140 18.8	8.8	22 50.0	4.7	56.4
22	148 51.6	47.1	154 46.6	8.8	22 45.3	4.9	56.4
23	163 51.4	46.9	169 14.4	8.9	S22 40.4	5.0	56.4
	SD 16.3	d 0.2	SD 15.7		15.6		15.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 1	Moonrise 2	Moonrise 3	Moonrise 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 23	10 40	▬	▬	▬	▬	▬
N 70	08 04	09 48	▬	▬	▬	▬	▬
68	07 49	09 16	▬	▬	▬	▬	11 24
66	07 37	08 52	10 27	08 39	▬	10 35	10 21
64	07 26	08 34	09 49	07 34	08 52	09 31	09 46
62	07 17	08 18	09 22	06 59	08 11	08 56	09 21
60	07 09	08 05	09 02	06 34	07 43	08 31	09 00
N 58	07 02	07 54	08 45	06 14	07 21	08 10	08 44
56	06 55	07 44	08 31	05 58	07 03	07 54	08 30
54	06 50	07 35	08 19	05 44	06 48	07 39	08 18
52	06 44	07 28	08 08	05 31	06 35	07 27	08 07
50	06 39	07 20	07 58	05 20	06 24	07 16	07 57
45	06 28	07 05	07 38	04 58	06 00	06 53	07 37
N 40	06 18	06 52	07 22	04 40	05 41	06 35	07 20
35	06 09	06 40	07 08	04 25	05 25	06 19	07 06
30	06 00	06 30	06 56	04 12	05 11	06 06	06 54
20	05 44	06 11	06 35	03 49	04 48	05 43	06 33
N 10	05 28	05 54	06 17	03 30	04 27	05 23	06 15
0	05 12	05 38	06 00	03 12	04 09	05 05	05 58
S 10	04 53	05 20	05 43	02 54	03 50	04 46	05 41
20	04 31	05 00	05 24	02 35	03 29	04 26	05 23
30	04 02	04 36	05 03	02 13	03 06	04 03	05 02
35	03 44	04 21	04 50	02 00	02 53	03 50	04 50
40	03 22	04 03	04 35	01 46	02 37	03 34	04 36
45	02 52	03 41	04 18	01 28	02 18	03 16	04 19
S 50	02 08	03 12	03 56	01 07	01 55	02 53	03 58
52	01 42	02 57	03 45	00 56	01 43	02 41	03 48
54	01 02	02 40	03 33	00 45	01 31	02 29	03 37
56	////	02 19	03 20	00 32	01 16	02 14	03 24
58	////	01 51	03 04	00 17	00 59	01 57	03 09
S 60	////	01 08	02 44	24 38	00 38	01 37	02 51

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 1	Moonset 2	Moonset 3	Moonset 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 28	15 45	▬	▬	▬	▬
N 70	▬	14 20	16 04	▬	▬	▬	▬
68	▬	14 52	16 19	▬	▬	▬	13 08
66	13 42	15 16	16 31	10 07	▬	12 05	14 10
64	14 19	15 34	16 42	11 12	11 53	13 09	14 45
62	14 46	15 50	16 51	11 47	12 33	13 44	15 10
60	15 06	16 03	16 59	12 13	13 01	14 09	15 29
N 58	15 23	16 14	17 06	12 33	13 23	14 29	15 45
56	15 37	16 24	17 13	12 49	13 41	14 45	15 59
54	15 49	16 33	17 18	13 04	13 56	14 59	16 11
52	16 00	16 40	17 24	13 16	14 09	15 12	16 21
50	16 10	16 48	17 29	13 27	14 20	15 22	16 30
45	16 30	17 03	17 40	13 50	14 44	15 45	16 50
N 40	16 46	17 16	17 50	14 09	15 03	16 03	17 06
35	17 00	17 28	17 59	14 24	15 19	16 18	17 19
30	17 12	17 38	18 08	14 38	15 33	16 31	17 31
20	17 33	17 56	18 24	15 01	15 56	16 54	17 50
N 10	17 51	18 13	18 40	15 20	16 17	17 13	18 07
0	18 08	18 30	18 56	15 39	16 36	17 31	18 23
S 10	18 25	18 48	19 15	15 58	16 54	17 49	18 39
20	18 43	19 08	19 37	16 18	17 15	18 08	18 56
30	19 05	19 32	20 05	16 40	17 38	18 30	19 15
35	19 17	19 47	20 23	16 54	17 52	18 42	19 26
40	19 32	20 05	20 46	17 10	18 07	18 57	19 39
45	19 50	20 27	21 15	17 28	18 26	19 14	19 54
S 50	20 11	20 55	21 59	17 51	18 49	19 36	20 12
52	20 22	21 10	22 24	18 02	19 01	19 46	20 21
54	20 34	21 27	23 03	18 15	19 13	19 58	20 31
56	20 47	21 48	////	18 29	19 28	20 11	20 42
58	21 03	22 15	////	18 46	19 45	20 26	20 54
S 60	21 23	22 57	////	19 07	20 06	20 44	21 08

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
1	03 11	03 25	12 03	09 25	21 54	27	9
2	03 39	03 53	12 04	10 22	22 50	28	4
3	04 07	04 21	12 04	11 18	23 45	29	1

SATURDAY SUNDAY MONDAY

UT	ARIES	VENUS −4.6		MARS +1.2		JUPITER −2.3		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
4 00	103 15.6	228 13.9	S15 57.0	170 42.9	S22 50.2	105 32.8	S 2 21.5	266 51.6	S 4 21.5
01	118 18.1	243 13.9	57.5	185 43.3	49.9	120 34.9	21.4	281 53.9	21.5
02	133 20.6	258 13.9	58.1	200 43.7	49.6	135 37.1	21.2	296 56.3	21.5
03	148 23.0	273 13.9 . .	58.7	215 44.1 . .	49.3	150 39.2 . .	21.1	311 58.7 . .	21.6
04	163 25.5	288 13.8	59.2	230 44.5	49.0	165 41.4	20.9	327 01.0	21.6
05	178 27.9	303 13.8	15 59.8	245 44.8	48.7	180 43.5	20.8	342 03.4	21.6
06	193 30.4	318 13.8	S16 00.3	260 45.2	S22 48.4	195 45.6	S 2 20.6	357 05.8	S 4 21.7
07	208 32.9	333 13.7	00.9	275 45.6	48.1	210 47.8	20.5	12 08.2	21.7
08	223 35.3	348 13.7	01.5	290 46.0	47.9	225 49.9	20.3	27 10.5	21.7
T 09	238 37.8	3 13.7 . .	02.0	305 46.4 . .	47.6	240 52.1 . .	20.2	42 12.9 . .	21.7
U 10	253 40.3	18 13.6	02.6	320 46.8	47.3	255 54.2	20.0	57 15.3	21.8
E 11	268 42.7	33 13.6	03.1	335 47.1	47.0	270 56.3	19.9	72 17.6	21.8
S 12	283 45.2	48 13.5	S16 03.7	350 47.5	S22 46.7	285 58.5	S 2 19.7	87 20.0	S 4 21.8
D 13	298 47.7	63 13.5	04.2	5 47.9	46.4	301 00.6	19.6	102 22.4	21.8
A 14	313 50.1	78 13.5	04.8	20 48.3	46.1	316 02.8	19.4	117 24.8	21.9
Y 15	328 52.6	93 13.4 . .	05.4	35 48.7 . .	45.8	331 04.9 . .	19.3	132 27.1 . .	21.9
16	343 55.1	108 13.4	05.9	50 49.1	45.5	346 07.0	19.1	147 29.5	21.9
17	358 57.5	123 13.3	06.5	65 49.4	45.2	1 09.2	19.0	162 31.9	21.9
18	14 00.0	138 13.3	S16 07.0	80 49.8	S22 44.9	16 11.3	S 2 18.8	177 34.2	S 4 22.0
19	29 02.4	153 13.3	07.6	95 50.2	44.6	31 13.5	18.7	192 36.6	22.0
20	44 04.9	168 13.2	08.1	110 50.6	44.4	46 15.6	18.5	207 39.0	22.0
21	59 07.4	183 13.2 . .	08.7	125 51.0 . .	44.1	61 17.7 . .	18.4	222 41.4 . .	22.0
22	74 09.8	198 13.1	09.3	140 51.4	43.8	76 19.9	18.2	237 43.7	22.1
23	89 12.3	213 13.1	09.8	155 51.8	43.5	91 22.0	18.1	252 46.1	22.1
5 00	104 14.8	228 13.0	S16 10.4	170 52.1	S22 43.2	106 24.2	S 2 17.9	267 48.5	S 4 22.1
01	119 17.2	243 13.0	10.9	185 52.5	42.9	121 26.3	17.8	282 50.8	22.1
02	134 19.7	258 12.9	11.5	200 52.9	42.6	136 28.4	17.6	297 53.2	22.2
03	149 22.2	273 12.9 . .	12.0	215 53.3 . .	42.3	151 30.6 . .	17.5	312 55.6 . .	22.2
04	164 24.6	288 12.8	12.6	230 53.7	42.0	166 32.7	17.3	327 58.0	22.2
05	179 27.1	303 12.8	13.1	245 54.1	41.7	181 34.8	17.2	343 00.3	22.2
06	194 29.6	318 12.7	S16 13.7	260 54.5	S22 41.4	196 37.0	S 2 17.0	358 02.7	S 4 22.3
W 07	209 32.0	333 12.6	14.3	275 54.8	41.1	211 39.1	16.9	13 05.1	22.3
E 08	224 34.5	348 12.6	14.8	290 55.2	40.8	226 41.2	16.7	28 07.5	22.3
D 09	239 36.9	3 12.5 . .	15.4	305 55.6 . .	40.5	241 43.4 . .	16.5	43 09.8 . .	22.3
N 10	254 39.4	18 12.5	15.9	320 56.0	40.2	256 45.5	16.4	58 12.2	22.4
E 11	269 41.9	33 12.4	16.5	335 56.4	39.9	271 47.7	16.2	73 14.6	22.4
S 12	284 44.3	48 12.4	S16 17.0	350 56.8	S22 39.6	286 49.8	S 2 16.1	88 17.0	S 4 22.4
D 13	299 46.8	63 12.3	17.6	5 57.2	39.3	301 51.9	15.9	103 19.3	22.4
A 14	314 49.3	78 12.2	18.1	20 57.5	39.0	316 54.1	15.8	118 21.7	22.5
Y 15	329 51.7	93 12.2 . .	18.7	35 57.9 . .	38.7	331 56.2 . .	15.6	133 24.1 . .	22.5
16	344 54.2	108 12.1	19.3	50 58.3	38.4	346 58.3	15.5	148 26.5	22.5
17	359 56.7	123 12.0	19.8	65 58.7	38.1	2 00.5	15.3	163 28.8	22.5
18	14 59.1	138 12.0	S16 20.4	80 59.1	S22 37.8	17 02.6	S 2 15.2	178 31.2	S 4 22.6
19	30 01.6	153 11.9	20.9	95 59.5	37.5	32 04.7	15.0	193 33.6	22.6
20	45 04.0	168 11.8	21.5	110 59.9	37.1	47 06.9	14.9	208 36.0	22.6
21	60 06.5	183 11.8 . .	22.0	126 00.2 . .	36.8	62 09.0 . .	14.7	223 38.3 . .	22.6
22	75 09.0	198 11.7	22.6	141 00.6	36.5	77 11.1	14.6	238 40.7	22.7
23	90 11.4	213 11.6	23.1	156 01.0	36.2	92 13.3	14.4	253 43.1	22.7
6 00	105 13.9	228 11.5	S16 23.7	171 01.4	S22 35.9	107 15.4	S 2 14.3	268 45.5	S 4 22.7
01	120 16.4	243 11.5	24.2	186 01.8	35.6	122 17.5	14.1	283 47.8	22.7
02	135 18.8	258 11.4	24.8	201 02.2	35.3	137 19.7	13.9	298 50.2	22.8
03	150 21.3	273 11.3 . .	25.3	216 02.6 . .	35.0	152 21.8 . .	13.8	313 52.6 . .	22.8
04	165 23.8	288 11.2	25.9	231 03.0	34.7	167 23.9	13.6	328 55.0	22.8
05	180 26.2	303 11.2	26.4	246 03.3	34.4	182 26.0	13.5	343 57.4	22.8
06	195 28.7	318 11.1	S16 27.0	261 03.7	S22 34.1	197 28.2	S 2 13.3	358 59.7	S 4 22.8
07	210 31.2	333 11.0	27.5	276 04.1	33.8	212 30.3	13.2	14 02.1	22.9
T 08	225 33.6	348 10.9	28.1	291 04.5	33.5	227 32.4	13.0	29 04.5	22.9
H 09	240 36.1	3 10.8 . .	28.6	306 04.9 . .	33.1	242 34.6 . .	12.9	44 06.9 . .	22.9
U 10	255 38.5	18 10.8	29.2	321 05.3	32.8	257 36.7	12.7	59 09.2	22.9
R 11	270 41.0	33 10.7	29.7	336 05.7	32.5	272 38.8	12.6	74 11.6	23.0
S 12	285 43.5	48 10.6	S16 30.3	351 06.1	S22 32.2	287 41.0	S 2 12.4	89 14.0	S 4 23.0
D 13	300 45.9	63 10.5	30.8	6 06.5	31.9	302 43.1	12.2	104 16.4	23.0
A 14	315 48.4	78 10.4	31.4	21 06.8	31.6	317 45.2	12.1	119 18.8	23.0
Y 15	330 50.9	93 10.3 . .	31.9	36 07.2 . .	31.3	332 47.3 . .	11.9	134 21.1 . .	23.0
16	345 53.3	108 10.2	32.5	51 07.6	30.9	347 49.5	11.8	149 23.5	23.1
17	0 55.8	123 10.2	33.0	66 08.0	30.6	2 51.6	11.6	164 25.9	23.1
18	15 58.3	138 10.1	S16 33.6	81 08.4	S22 30.3	17 53.7	S 2 11.5	179 28.3	S 4 23.1
19	31 00.7	153 10.0	34.1	96 08.8	30.0	32 55.9	11.3	194 30.7	23.1
20	46 03.2	168 09.9	34.7	111 09.2	29.7	47 58.0	11.2	209 33.0	23.2
21	61 05.7	183 09.8 . .	35.2	126 09.6 . .	29.4	63 00.1 . .	11.0	224 35.4 . .	23.2
22	76 08.1	198 09.7	35.8	141 10.0	29.1	78 02.2	10.9	239 37.8	23.2
23	91 10.6	213 09.6	36.3	156 10.3	28.7	93 04.4	10.7	254 40.2	23.2
	h m								
Mer. Pass.	17 00.2	*v* −0.1	*d* 0.6	*v* 0.4	*d* 0.3	*v* 2.1	*d* 0.2	*v* 2.4	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.8
Achernar	335 27.8	S57 11.1
Acrux	173 11.3	S63 09.4
Adhara	255 13.5	S28 59.3
Aldebaran	290 51.1	N16 31.9
Alioth	166 22.1	N55 53.6
Alkaid	153 00.3	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.5	S 8 42.5
Alphecca	126 12.7	N26 40.5
Alpheratz	357 45.4	N29 09.3
Altair	62 10.3	N 8 53.9
Ankaa	353 17.4	S42 14.9
Antares	112 28.7	S26 27.3
Arcturus	145 57.4	N19 07.3
Atria	107 32.7	S69 02.7
Avior	234 18.2	S59 32.7
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.8	N 7 24.5
Canopus	263 56.4	S52 42.2
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.4
Denebola	182 35.3	N14 30.4
Diphda	348 57.6	S17 55.6
Dubhe	193 53.4	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.5	N51 29.2
Enif	33 49.1	N 9 55.7
Fomalhaut	15 26.0	S29 33.9
Gacrux	172 02.9	S57 10.3
Gienah	175 54.1	S17 36.2
Hadar	148 50.7	S60 25.4
Hamal	328 02.6	N23 31.0
Kaus Aust.	83 46.5	S34 22.7
Kochab	137 20.4	N74 06.2
Markab	13 40.2	N15 16.0
Menkar	314 16.7	N 4 08.0
Menkent	148 09.8	S36 25.4
Miaplacidus	221 39.4	S69 45.7
Mirfak	308 42.6	N49 54.2
Nunki	76 00.8	S26 16.9
Peacock	53 22.5	S56 42.0
Pollux	243 29.5	N27 59.8
Procyon	245 01.2	N 5 11.7
Rasalhague	96 08.4	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.4	S 8 11.4
Rigil Kent.	139 54.5	S60 52.6
Sabik	102 14.9	S15 44.3
Schedar	349 42.6	N56 36.2
Shaula	96 24.7	S37 06.6
Sirius	258 34.9	S16 44.0
Spica	158 33.1	S11 13.2
Suhail	222 53.4	S43 28.6
Vega	80 40.6	N38 47.6
Zuben'ubi	137 07.5	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	123 58.3	8 47
Mars	66 37.4	12 36
Jupiter	2 09.4	16 52
Saturn	163 33.7	6 08

UT	SUN				MOON					
	GHA		Dec		GHA	v	Dec	d	HP	
d h	°	′	°	′	°	′	°	′	′	′
4 00	178	51.1	S22	46.6	183	42.3	9.0	S22	35.4	5.1	56.4
01	193	50.8		46.4	198	10.3	9.0	22	30.3	5.3	56.3
02	208	50.5		46.1	212	38.3	9.1	22	25.0	5.4	56.3
03	223	50.2	. .	45.9	227	06.4	9.2	22	19.6	5.4	56.3
04	238	49.9		45.6	241	34.6	9.2	22	14.2	5.6	56.3
05	253	49.6		45.3	256	02.8	9.3	S22	08.6	5.7	56.2
06	268	49.4	S22	45.1							
07	283	49.1		44.8							
08	298	48.8		44.6							
09	313	48.5	. .	44.3							
10	328	48.2		44.1							
11	343	47.9		43.8							
12	358	47.6	S22	43.5	357	22.6	9.8	S21	26.3	6.5	56.1
13	13	47.4		43.3	11	51.4	10.0	21	19.8	6.6	56.1
14	28	47.1		43.0	26	20.4	10.0	21	13.2	6.7	56.0
15	43	46.8	. .	42.7	40	49.4	10.0	21	06.5	6.8	56.0
16	58	46.5		42.5	55	18.4	10.2	20	59.7	6.9	56.0
17	73	46.2		42.2	69	47.6	10.2	20	52.8	7.0	56.0
18	88	45.9	S22	41.9	84	16.8	10.3	S20	45.8	7.1	56.0
19	103	45.7		41.7	98	46.1	10.4	20	38.7	7.2	55.9
20	118	45.4		41.4	113	15.5	10.4	20	31.5	7.3	55.9
21	133	45.1	. .	41.1	127	44.9	10.6	20	24.2	7.4	55.9
22	148	44.8		40.9	142	14.5	10.6	20	16.8	7.5	55.9
23	163	44.5		40.6	156	44.1	10.7	20	09.3	7.5	55.9
5 00	178	44.2	S22	40.3	171	13.8	10.7	S20	01.8	7.7	55.8
01	193	44.0		40.1	185	43.5	10.9	19	54.1	7.8	55.8
02	208	43.7		39.8	200	13.4	10.9	19	46.3	7.9	55.8
03	223	43.4	. .	39.5	214	43.3	11.0	19	38.4	7.9	55.8
04	238	43.1		39.2	229	13.3	11.1	19	30.5	8.1	55.7
05	253	42.8		39.0	243	43.4	11.2	19	22.4	8.1	55.7
06	268	42.5	S22	38.7	258	13.6	11.2	S19	14.3	8.2	55.7
07	283	42.3		38.4	272	43.8	11.3	19	06.1	8.3	55.7
08	298	42.0		38.1	287	14.1	11.4	18	57.8	8.4	55.7
09	313	41.7	. .	37.9	301	44.5	11.5	18	49.4	8.5	55.6
10	328	41.4		37.6	316	15.0	11.6	18	40.9	8.6	55.6
11	343	41.1		37.3	330	45.6	11.6	18	32.3	8.6	55.6
12	358	40.9	S22	37.0	345	16.2	11.7	S18	23.7	8.7	55.6
13	13	40.6		36.7	359	46.9	11.8	18	15.0	8.8	55.6
14	28	40.3		36.5	14	17.7	11.9	18	06.2	8.9	55.5
15	43	40.0	. .	36.2	28	48.6	12.0	17	57.3	9.0	55.5
16	58	39.7		35.9	43	19.6	12.0	17	48.3	9.0	55.5
17	73	39.5		35.6	57	50.6	12.1	17	39.3	9.1	55.5
18	88	39.2	S22	35.3	72	21.7	12.2	S17	30.2	9.2	55.5
19	103	38.9		35.0	86	52.9	12.2	17	21.0	9.3	55.4
20	118	38.6		34.8	101	24.1	12.4	17	11.7	9.3	55.4
21	133	38.3	. .	34.5	115	55.5	12.4	17	02.4	9.4	55.4
22	148	38.1		34.2	130	26.9	12.5	16	53.0	9.5	55.4
23	163	37.8		33.9	144	58.4	12.5	16	43.5	9.5	55.4
6 00	178	37.5	S22	33.6	159	29.9	12.7	S16	34.0	9.7	55.3
01	193	37.2		33.3	174	01.6	12.7	16	24.3	9.6	55.3
02	208	37.0		33.0	188	33.3	12.8	16	14.7	9.8	55.3
03	223	36.7	. .	32.7	203	05.1	12.8	16	04.9	9.8	55.3
04	238	36.4		32.4	217	36.9	13.0	15	55.1	9.9	55.3
05	253	36.1		32.1	232	08.9	13.0	15	45.2	9.9	55.2
06	268	35.8	S22	31.8	246	40.9	13.1	S15	35.3	10.0	55.2
07	283	35.6		31.6	261	13.0	13.1	15	25.3	10.1	55.2
08	298	35.3		31.3	275	45.1	13.3	15	15.2	10.1	55.2
09	313	35.0	. .	31.0	290	17.4	13.3	15	05.1	10.2	55.2
10	328	34.7		30.7	304	49.7	13.3	14	54.9	10.2	55.1
11	343	34.5		30.4	319	22.0	13.5	14	44.7	10.3	55.1
12	358	34.2	S22	30.1	333	54.5	13.5	S14	34.4	10.4	55.1
13	13	33.9		29.8	348	27.0	13.5	14	24.0	10.4	55.1
14	28	33.6		29.5	2	59.5	13.7	14	13.6	10.4	55.1
15	43	33.4	. .	29.2	17	32.2	13.7	14	03.2	10.5	55.0
16	58	33.1		28.9	32	04.9	13.8	13	52.7	10.6	55.0
17	73	32.8		28.6	46	37.7	13.8	13	42.1	10.6	55.0
18	88	32.5	S22	28.3	61	10.5	13.9	S13	31.5	10.7	55.0
19	103	32.3		28.0	75	43.4	14.0	13	20.8	10.7	55.0
20	118	32.0		27.7	90	16.4	14.0	13	10.1	10.8	55.0
21	133	31.7	. .	27.3	104	49.4	14.1	12	59.3	10.8	54.9
22	148	31.4		27.0	119	22.5	14.2	12	48.5	10.8	54.9
23	163	31.2		26.7	133	55.7	14.2	S12	37.7	10.9	54.9
	SD	16.3	d	0.3	SD		15.3		15.1		15.0

A partial eclipse of the Sun occurs on this date. See page 5.

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 4	Moonrise 5	Moonrise 6	Moonrise 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 20	10 31	▬	▬	▬	11 21	10 45
N 70	08 02	09 43	▬	▬	11 28	10 50	10 28
68	07 47	09 13	11 32	11 24	10 44	10 27	10 15
66	07 35	08 50	10 20	10 21	10 14	10 09	10 04
64	07 25	08 32	09 45	09 46	09 52	09 54	09 55
62	07 16	08 17	09 20	09 21	09 34	09 42	09 47
60	07 08	08 04	09 00	09 00	09 19	09 31	09 40
N 58	07 01	07 53	08 44	08 44	09 06	09 22	09 34
56	06 55	07 43	08 30	08 30	08 55	09 14	09 29
54	06 49	07 35	08 18	08 18	08 46	09 07	09 24
52	06 44	07 27	08 07	08 07	08 37	09 00	09 19
50	06 39	07 20	07 58	07 57	08 29	08 54	09 15
45	06 28	07 05	07 38	07 37	08 12	08 42	09 07
N 40	06 18	06 52	07 22	07 20	07 59	08 31	08 59
35	06 09	06 41	07 08	07 06	07 47	08 22	08 53
30	06 01	06 30	06 57	06 54	07 37	08 14	08 47
20	05 45	06 12	06 36	06 33	07 19	08 00	08 38
N 10	05 29	05 56	06 18	06 15	07 04	07 48	08 29
0	05 13	05 39	06 02	05 58	06 49	07 37	08 21
S 10	04 55	05 22	05 45	05 41	06 35	07 25	08 13
20	04 33	05 02	05 26	05 23	06 19	07 13	08 05
30	04 05	04 38	05 05	05 02	06 01	06 59	07 55
35	03 47	04 23	04 53	04 50	05 51	06 51	07 49
40	03 25	04 06	04 38	04 36	05 39	06 41	07 43
45	02 55	03 44	04 21	04 19	05 25	06 30	07 35
S 50	02 13	03 16	03 59	03 58	05 07	06 17	07 26
52	01 48	03 01	03 49	03 48	04 59	06 11	07 22
54	01 12	02 45	03 37	03 37	04 50	06 04	07 17
56	////	02 24	03 24	03 24	04 39	05 56	07 12
58	////	01 58	03 08	03 09	04 27	05 47	07 06
S 60	////	01 18	02 49	02 51	04 14	05 37	06 59

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 4	Moonset 5	Moonset 6	Moonset 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 40	15 51	▬	▬	16 35	18 42
N 70	▬	14 28	16 09	▬	14 49	17 04	18 56
68	12 39	14 58	16 24	13 08	15 32	17 25	19 08
66	13 50	15 21	16 36	14 10	16 00	17 42	19 17
64	14 26	15 39	16 46	14 45	16 22	17 56	19 25
62	14 51	15 54	16 55	15 10	16 39	18 07	19 32
60	15 11	16 07	17 03	15 29	16 53	18 17	19 38
N 58	15 27	16 18	17 10	15 45	17 05	18 25	19 43
56	15 41	16 27	17 16	15 59	17 16	18 33	19 47
54	15 53	16 36	17 22	16 11	17 25	18 39	19 51
52	16 03	16 44	17 27	16 21	17 33	18 45	19 55
50	16 13	16 51	17 32	16 30	17 41	18 50	19 58
45	16 33	17 06	17 43	16 50	17 56	19 02	20 06
N 40	16 49	17 19	17 53	17 06	18 09	19 11	20 11
35	17 02	17 30	18 02	17 19	18 20	19 19	20 17
30	17 14	17 40	18 10	17 31	18 29	19 26	20 21
20	17 34	17 58	18 26	17 50	18 45	19 38	20 29
N 10	17 52	18 15	18 41	18 07	18 59	19 49	20 36
0	18 09	18 31	18 57	18 23	19 12	19 58	20 42
S 10	18 26	18 49	19 16	18 39	19 25	20 08	20 48
20	18 44	19 08	19 37	18 56	19 39	20 18	20 55
30	19 05	19 32	20 05	19 15	19 55	20 30	21 02
35	19 18	19 47	20 23	19 26	20 04	20 37	21 06
40	19 32	20 05	20 45	19 39	20 14	20 45	21 11
45	19 49	20 26	21 14	19 54	20 26	20 53	21 17
S 50	20 11	20 54	21 56	20 12	20 41	21 04	21 23
52	20 21	21 08	22 21	20 21	20 48	21 09	21 26
54	20 33	21 25	22 56	20 31	20 55	21 14	21 30
56	20 46	21 45	////	20 42	21 04	21 20	21 33
58	21 02	22 11	////	20 54	21 13	21 27	21 37
S 60	21 20	22 50	////	21 08	21 24	21 34	21 42

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
4	04 35	04 49	12 05	12 11	24 36	00	0
5	05 02	05 16	12 05	13 01	00 36	01	1
6	05 29	05 43	12 06	13 48	01 25	02	5

UT	ARIES	VENUS −4.6		MARS +1.2		JUPITER −2.3		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
7 00	106 13.0	228 09.5	S16 36.9	171 10.7	S22 28.4	108 06.5	S 2 10.5	269 42.6	S 4 23.2
01	121 15.5	243 09.4	37.4	186 11.1	28.1	123 08.6	10.4	284 44.9	23.3
02	136 18.0	258 09.3	38.0	201 11.5	27.8	138 10.7	10.2	299 47.3	23.3
03	151 20.4	273 09.2	38.5	216 11.9	27.5	153 12.9	10.1	314 49.7	23.3
04	166 22.9	288 09.1	39.1	231 12.3	27.1	168 15.0	09.9	329 52.1	23.3
05	181 25.4	303 09.0	39.6	246 12.7	26.8	183 17.1	09.8	344 54.5	23.4
06	196 27.8	318 08.9	S16 40.2	261 13.1	S22 26.5	198 19.2	S 2 09.6	359 56.8	S 4 23.4
07	211 30.3	333 08.8	40.7	276 13.5	26.2	213 21.4	09.4	14 59.2	23.4
08	226 32.8	348 08.7	41.3	291 13.8	25.9	228 23.5	09.3	30 01.6	23.4
F 09	241 35.2	3 08.6	41.8	306 14.2	25.5	243 25.6	09.1	45 04.0	23.4
R 10	256 37.7	18 08.5	42.4	321 14.6	25.2	258 27.7	09.0	60 06.4	23.5
I 11	271 40.2	33 08.4	42.9	336 15.0	24.9	273 29.9	08.8	75 08.8	23.5
D 12	286 42.6	48 08.3	S16 43.4	351 15.4	S22 24.6	288 32.0	S 2 08.7	90 11.1	S 4 23.5
A 13	301 45.1	63 08.2	44.0	6 15.8	24.3	303 34.1	08.5	105 13.5	23.5
Y 14	316 47.5	78 08.1	44.5	21 16.2	23.9	318 36.2	08.4	120 15.9	23.5
15	331 50.0	93 08.0	45.1	36 16.6	23.6	333 38.4	08.2	135 18.3	23.6
16	346 52.5	108 07.8	45.6	51 17.0	23.3	348 40.5	08.0	150 20.7	23.6
17	1 54.9	123 07.7	46.2	66 17.4	23.0	3 42.6	07.9	165 23.1	23.6
18	16 57.4	138 07.6	S16 46.7	81 17.8	S22 22.6	18 44.7	S 2 07.7	180 25.4	S 4 23.6
19	31 59.9	153 07.5	47.3	96 18.1	22.3	33 46.9	07.6	195 27.8	23.6
20	47 02.3	168 07.4	47.8	111 18.5	22.0	48 49.0	07.4	210 30.2	23.7
21	62 04.8	183 07.3	48.3	126 18.9	21.6	63 51.1	07.2	225 32.6	23.7
22	77 07.3	198 07.2	48.9	141 19.3	21.3	78 53.2	07.1	240 35.0	23.7
23	92 09.7	213 07.0	49.4	156 19.7	21.0	93 55.3	06.9	255 37.4	23.7
8 00	107 12.2	228 06.9	S16 50.0	171 20.1	S22 20.7	108 57.5	S 2 06.8	270 39.7	S 4 23.8
01	122 14.6	243 06.8	50.5	186 20.5	20.3	123 59.6	06.6	285 42.1	23.8
02	137 17.1	258 06.7	51.1	201 20.9	20.0	139 01.7	06.5	300 44.5	23.8
03	152 19.6	273 06.6	51.6	216 21.3	19.7	154 03.8	06.3	315 46.9	23.8
04	167 22.0	288 06.4	52.1	231 21.7	19.3	169 06.0	06.1	330 49.3	23.8
05	182 24.5	303 06.3	52.7	246 22.1	19.0	184 08.1	06.0	345 51.7	23.9
06	197 27.0	318 06.2	S16 53.2	261 22.5	S22 18.7	199 10.2	S 2 05.8	0 54.1	S 4 23.9
07	212 29.4	333 06.1	53.8	276 22.9	18.4	214 12.3	05.7	15 56.4	23.9
S 08	227 31.9	348 05.9	54.3	291 23.2	18.0	229 14.4	05.5	30 58.8	23.9
A 09	242 34.4	3 05.8	54.8	306 23.6	17.7	244 16.6	05.4	46 01.2	23.9
T 10	257 36.8	18 05.7	55.4	321 24.0	17.4	259 18.7	05.2	61 03.6	23.9
U 11	272 39.3	33 05.6	55.9	336 24.4	17.0	274 20.8	05.0	76 06.0	24.0
R 12	287 41.8	48 05.4	S16 56.5	351 24.8	S22 16.7	289 22.9	S 2 04.9	91 08.4	S 4 24.0
D 13	302 44.2	63 05.3	57.0	6 25.2	16.4	304 25.0	04.7	106 10.8	24.0
A 14	317 46.7	78 05.2	57.5	21 25.6	16.0	319 27.1	04.6	121 13.1	24.0
Y 15	332 49.1	93 05.0	58.1	36 26.0	15.7	334 29.3	04.4	136 15.5	24.0
16	347 51.6	108 04.9	58.6	51 26.4	15.4	349 31.4	04.2	151 17.9	24.1
17	2 54.1	123 04.8	59.2	66 26.8	15.0	4 33.5	04.1	166 20.3	24.1
18	17 56.5	138 04.6	S16 59.7	81 27.2	S22 14.7	19 35.6	S 2 03.9	181 22.7	S 4 24.1
19	32 59.0	153 04.5	17 00.2	96 27.6	14.3	34 37.7	03.8	196 25.1	24.1
20	48 01.5	168 04.4	00.8	111 28.0	14.0	49 39.9	03.6	211 27.5	24.1
21	63 03.9	183 04.2	01.3	126 28.4	13.7	64 42.0	03.4	226 29.9	24.2
22	78 06.4	198 04.1	01.8	141 28.8	13.3	79 44.1	03.3	241 32.2	24.2
23	93 08.9	213 03.9	02.4	156 29.1	13.0	94 46.2	03.1	256 34.6	24.2
9 00	108 11.3	228 03.8	S17 02.9	171 29.5	S22 12.7	109 48.3	S 2 03.0	271 37.0	S 4 24.2
01	123 13.8	243 03.7	03.4	186 29.9	12.3	124 50.4	02.8	286 39.4	24.2
02	138 16.3	258 03.5	04.0	201 30.3	12.0	139 52.5	02.6	301 41.8	24.3
03	153 18.7	273 03.4	04.5	216 30.7	11.6	154 54.7	02.5	316 44.2	24.3
04	168 21.2	288 03.2	05.1	231 31.1	11.3	169 56.8	02.3	331 46.6	24.3
05	183 23.6	303 03.1	05.6	246 31.5	11.0	184 58.9	02.2	346 49.0	24.3
06	198 26.1	318 02.9	S17 06.1	261 31.9	S22 10.6	200 01.0	S 2 02.0	1 51.4	S 4 24.3
07	213 28.6	333 02.8	06.7	276 32.3	10.3	215 03.1	01.8	16 53.7	24.3
08	228 31.0	348 02.7	07.2	291 32.7	09.9	230 05.2	01.7	31 56.1	24.4
S 09	243 33.5	3 02.5	07.7	306 33.1	09.6	245 07.4	01.5	46 58.5	24.4
U 10	258 36.0	18 02.4	08.3	321 33.5	09.2	260 09.5	01.4	62 00.9	24.4
N 11	273 38.4	33 02.2	08.8	336 33.9	08.9	275 11.6	01.2	77 03.3	24.4
D 12	288 40.9	48 02.1	S17 09.3	351 34.3	S22 08.6	290 13.7	S 2 01.0	92 05.7	S 4 24.4
A 13	303 43.4	63 01.9	09.9	6 34.7	08.2	305 15.8	00.9	107 08.1	24.4
Y 14	318 45.8	78 01.7	10.4	21 35.1	07.9	320 17.9	00.7	122 10.5	24.5
15	333 48.3	93 01.6	10.9	36 35.5	07.5	335 20.0	00.5	137 12.9	24.5
16	348 50.7	108 01.4	11.5	51 35.9	07.2	350 22.1	00.4	152 15.3	24.5
17	3 53.2	123 01.3	12.0	66 36.3	06.8	5 24.3	00.2	167 17.7	24.5
18	18 55.7	138 01.1	S17 12.5	81 36.7	S22 06.5	20 26.4	S 2 00.1	182 20.0	S 4 24.5
19	33 58.1	153 01.0	13.0	96 37.1	06.1	35 28.5	1 59.9	197 22.4	24.6
20	49 00.6	168 00.8	13.6	111 37.5	05.8	50 30.6	59.7	212 24.8	24.6
21	64 03.1	183 00.6	14.1	126 37.9	05.4	65 32.7	59.6	227 27.2	24.6
22	79 05.5	198 00.5	14.6	141 38.2	05.1	80 34.8	59.4	242 29.6	24.6
23	94 08.0	213 00.3	15.2	156 38.6	04.7	95 36.9	59.2	257 32.0	24.6
	h m								
Mer. Pass.	16 48.4	v −0.1	d 0.5	v 0.4	d 0.3	v 2.1	d 0.2	v 2.4	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.8
Achernar	335 27.9	S57 11.1
Acrux	173 11.2	S63 09.4
Adhara	255 13.5	S28 59.3
Aldebaran	290 51.1	N16 31.9
Alioth	166 22.1	N55 53.6
Alkaid	153 00.3	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.5	S 8 42.5
Alphecca	126 12.7	N26 40.5
Alpheratz	357 45.4	N29 09.3
Altair	62 10.3	N 8 53.9
Ankaa	353 17.4	S42 14.9
Antares	112 28.7	S26 27.3
Arcturus	145 57.4	N19 07.3
Atria	107 32.6	S69 02.7
Avior	234 18.2	S59 32.7
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.8	N 7 24.5
Canopus	263 56.4	S52 42.2
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.4
Denebola	182 35.3	N14 30.4
Diphda	348 57.6	S17 55.6
Dubhe	193 53.3	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.5	N51 29.2
Enif	33 49.1	N 9 55.7
Fomalhaut	15 26.1	S29 33.9
Gacrux	172 02.9	S57 10.3
Gienah	175 54.0	S17 36.2
Hadar	148 50.6	S60 25.4
Hamal	328 02.6	N23 31.0
Kaus Aust.	83 46.5	S34 22.7
Kochab	137 20.3	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.7	N 4 08.0
Menkent	148 09.8	S36 25.4
Miaplacidus	221 39.3	S69 45.7
Mirfak	308 42.6	N49 54.2
Nunki	76 00.8	S26 16.9
Peacock	53 22.5	S56 42.0
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.7
Rasalhague	96 08.4	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.4	S 8 11.4
Rigil Kent.	139 54.4	S60 52.6
Sabik	102 14.8	S15 44.3
Schedar	349 42.7	N56 36.2
Shaula	96 24.7	S37 06.6
Sirius	258 34.9	S16 44.0
Spica	158 33.1	S11 13.2
Suhail	222 53.4	S43 28.6
Vega	80 40.6	N38 47.6
Zuben'ubi	137 07.5	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	120 54.7	8 48
Mars	64 07.9	12 34
Jupiter	1 45.3	16 42
Saturn	163 27.6	5 56

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
7 00	178 30.9	S22 26.4	148 28.9	14.3	S12 26.8	11.0	54.9
01	193 30.6	26.1	163 02.2	14.4	12 15.8	11.0	54.9
02	208 30.3	25.8	177 35.6	14.4	12 04.8	11.0	54.9
03	223 30.1	25.5	192 09.0	14.4	11 53.8	11.1	54.8
04	238 29.8	25.2	206 42.4	14.6	11 42.7	11.1	54.8
05	253 29.5	24.9	221 16.0	14.5	11 31.6	11.2	54.8
06	268 29.3	S22 24.6	235 49.5	14.7	S11 20.4	11.1	54.8
07	283 29.0	24.2	250 23.2	14.7	11 09.3	11.3	54.8
08	298 28.7	23.9	264 56.9	14.7	10 58.0	11.2	54.8
F 09	313 28.4	23.6	279 30.6	14.8	10 46.8	11.4	54.7
R 10	328 28.2	23.3	294 04.4	14.9	10 35.4	11.3	54.7
I 11	343 27.9	23.0	308 38.3	14.9	10 24.1	11.4	54.7
D 12	358 27.6	S22 22.7	323 12.2	15.0	S10 12.7	11.4	54.7
A 13	13 27.4	22.4	337 46.2	15.0	10 01.3	11.4	54.7
Y 14	28 27.1	22.0	352 20.2	15.1	9 49.9	11.5	54.7
15	43 26.8	21.7	6 54.3	15.1	9 38.4	11.5	54.6
16	58 26.6	21.4	21 28.4	15.2	9 26.9	11.5	54.6
17	73 26.3	21.1	36 02.6	15.2	9 15.4	11.6	54.6
18	88 26.0	S22 20.8	50 36.8	15.3	S 9 03.8	11.6	54.6
19	103 25.7	20.4	65 11.1	15.3	8 52.2	11.6	54.6
20	118 25.5	20.1	79 45.4	15.3	8 40.6	11.7	54.6
21	133 25.2	19.8	94 19.7	15.4	8 28.9	11.6	54.6
22	148 24.9	19.5	108 54.1	15.5	8 17.3	11.7	54.5
23	163 24.7	19.1	123 28.6	15.5	8 05.6	11.8	54.5
8 00	178 24.4	S22 18.8	138 03.1	15.5	S 7 53.8	11.7	54.5
01	193 24.1	18.5	152 37.6	15.6	7 42.1	11.8	54.5
02	208 23.9	18.2	167 12.2	15.6	7 30.3	11.8	54.5
03	223 23.6	17.8	181 46.8	15.7	7 18.5	11.8	54.5
04	238 23.3	17.5	196 21.5	15.7	7 06.7	11.9	54.5
05	253 23.1	17.2	210 56.2	15.7	6 54.8	11.8	54.5
06	268 22.8	S22 16.8	225 30.9	15.8	S 6 43.0	11.9	54.4
07	283 22.5	16.5	240 05.7	15.8	6 31.1	11.9	54.4
S 08	298 22.3	16.2	254 40.5	15.8	6 19.2	11.9	54.4
A 09	313 22.0	15.8	269 15.3	15.9	6 07.3	11.9	54.4
T 10	328 21.7	15.5	283 50.2	15.9	5 55.4	12.0	54.4
U 11	343 21.5	15.2	298 25.1	16.0	5 43.4	12.0	54.4
R 12	358 21.2	S22 14.8	313 00.1	15.9	S 5 31.4	11.9	54.4
D 13	13 20.9	14.5	327 35.0	16.0	5 19.5	12.0	54.4
A 14	28 20.7	14.2	342 10.0	16.1	5 07.5	12.1	54.4
Y 15	43 20.4	13.8	356 45.1	16.0	4 55.4	12.0	54.3
16	58 20.1	13.5	11 20.1	16.1	4 43.4	12.0	54.3
17	73 19.9	13.1	25 55.2	16.2	4 31.4	12.1	54.3
18	88 19.6	S22 12.8	40 30.4	16.1	S 4 19.3	12.0	54.3
19	103 19.4	12.5	55 05.5	16.2	4 07.3	12.1	54.3
20	118 19.1	12.1	69 40.7	16.2	3 55.2	12.1	54.3
21	133 18.8	11.8	84 15.9	16.2	3 43.1	12.1	54.3
22	148 18.6	11.4	98 51.1	16.2	3 31.0	12.0	54.3
23	163 18.3	11.1	113 26.3	16.3	3 19.0	12.2	54.3
9 00	178 18.0	S22 10.7	128 01.6	16.3	S 3 06.8	12.1	54.3
01	193 17.8	10.4	142 36.9	16.3	2 54.7	12.1	54.3
02	208 17.5	10.1	157 12.2	16.3	2 42.6	12.1	54.2
03	223 17.2	09.7	171 47.5	16.4	2 30.5	12.1	54.2
04	238 17.0	09.4	186 22.9	16.3	2 18.4	12.2	54.2
05	253 16.7	09.0	200 58.2	16.4	2 06.2	12.1	54.2
06	268 16.5	S22 08.7	215 33.6	16.4	S 1 54.1	12.1	54.2
07	283 16.2	08.3	230 09.0	16.4	1 42.0	12.2	54.2
08	298 15.9	08.0	244 44.4	16.4	1 29.8	12.1	54.2
S 09	313 15.7	07.6	259 19.8	16.4	1 17.7	12.2	54.2
U 10	328 15.4	07.3	273 55.2	16.5	1 05.5	12.1	54.2
N 11	343 15.2	06.9	288 30.7	16.4	0 53.4	12.2	54.2
D 12	358 14.9	S22 06.6	303 06.1	16.5	S 0 41.2	12.1	54.2
A 13	13 14.6	06.2	317 41.6	16.5	0 29.1	12.1	54.2
Y 14	28 14.4	05.8	332 17.1	16.4	0 17.0	12.2	54.2
15	43 14.1	05.5	346 52.5	16.5	S 0 04.8	12.1	54.2
16	58 13.9	05.1	1 28.0	16.5	N 0 07.3	12.2	54.2
17	73 13.6	04.8	16 03.5	16.5	0 19.5	12.1	54.2
18	88 13.4	S22 04.4	30 39.0	16.5	N 0 31.6	12.1	54.2
19	103 13.1	04.1	45 14.5	16.5	0 43.7	12.1	54.2
20	118 12.8	03.7	59 50.0	16.5	0 55.8	12.1	54.2
21	133 12.6	03.3	74 25.5	16.5	1 07.9	12.2	54.2
22	148 12.3	03.0	89 01.0	16.5	1 20.1	12.1	54.2
23	163 12.1	02.6	103 36.5	16.5	N 1 32.2	12.1	54.2
	SD 16.3	d 0.3	SD	14.9		14.8	14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 7	Moonrise 8	Moonrise 9	Moonrise 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 15	10 20	▬	10 45	10 20	09 59	09 39
N 70	07 58	09 37	▬	10 28	10 12	09 57	09 43
68	07 44	09 08	11 11	10 15	10 05	09 56	09 47
66	07 33	08 46	10 13	10 04	09 59	09 55	09 51
64	07 23	08 29	09 40	09 55	09 55	09 54	09 54
62	07 14	08 14	09 16	09 47	09 50	09 53	09 56
60	07 07	08 02	08 57	09 40	09 47	09 53	09 58
N 58	07 00	07 51	08 41	09 34	09 43	09 52	10 00
56	06 54	07 42	08 28	09 29	09 41	09 51	10 02
54	06 48	07 34	08 16	09 24	09 38	09 51	10 04
52	06 43	07 26	08 06	09 19	09 36	09 50	10 05
50	06 38	07 19	07 57	09 15	09 33	09 50	10 06
45	06 28	07 04	07 38	09 07	09 29	09 49	10 09
N 40	06 18	06 52	07 22	08 59	09 25	09 48	10 12
35	06 09	06 41	07 09	08 53	09 21	09 48	10 14
30	06 01	06 31	06 57	08 47	09 18	09 47	10 16
20	05 46	06 13	06 37	08 38	09 13	09 46	10 19
N 10	05 31	05 57	06 19	08 29	09 08	09 45	10 22
0	05 15	05 41	06 03	08 21	09 03	09 44	10 25
S 10	04 57	05 23	05 46	08 13	08 59	09 43	10 27
20	04 35	05 04	05 28	08 05	08 54	09 43	10 30
30	04 07	04 40	05 07	07 55	08 49	09 42	10 34
35	03 50	04 26	04 55	07 49	08 46	09 41	10 36
40	03 28	04 09	04 41	07 43	08 42	09 40	10 38
45	03 00	03 48	04 24	07 35	08 38	09 40	10 41
S 50	02 19	03 20	04 03	07 26	08 33	09 39	10 44
52	01 55	03 06	03 53	07 22	08 31	09 38	10 45
54	01 21	02 50	03 42	07 17	08 28	09 38	10 47
56	////	02 30	03 28	07 12	08 25	09 37	10 49
58	////	02 05	03 13	07 06	08 22	09 37	10 51
S 60	////	01 28	02 55	06 59	08 19	09 36	10 53

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 7	Moonset 8	Moonset 9	Moonset 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 54	15 58	18 42	20 34	22 21	24 08
N 70	▬	14 37	16 16	18 56	20 39	22 19	23 58
68	13 03	15 06	16 29	19 08	20 44	22 17	23 51
66	14 00	15 27	16 41	19 17	20 48	22 16	23 44
64	14 33	15 45	16 51	19 25	20 51	22 15	23 39
62	14 57	15 59	16 59	19 32	20 54	22 14	23 34
60	15 16	16 11	17 07	19 38	20 56	22 13	23 30
N 58	15 32	16 22	17 14	19 43	20 58	22 12	23 26
56	15 45	16 31	17 20	19 47	21 00	22 12	23 23
54	15 57	16 40	17 25	19 51	21 02	22 11	23 20
52	16 07	16 47	17 30	19 55	21 03	22 11	23 18
50	16 16	16 54	17 35	19 58	21 05	22 10	23 15
45	16 36	17 09	17 46	20 06	21 08	22 09	23 10
N 40	16 51	17 22	17 55	20 11	21 10	22 08	23 06
35	17 05	17 33	18 04	20 17	21 13	22 08	23 02
30	17 16	17 42	18 12	20 21	21 14	22 07	22 59
20	17 36	18 00	18 27	20 29	21 18	22 06	22 54
N 10	17 54	18 16	18 43	20 36	21 21	22 05	22 49
0	18 10	18 33	18 59	20 42	21 23	22 04	22 44
S 10	18 27	18 50	19 17	20 48	21 26	22 03	22 40
20	18 45	19 09	19 38	20 55	21 29	22 02	22 35
30	19 06	19 33	20 05	21 02	21 32	22 00	22 29
35	19 18	19 47	20 23	21 06	21 34	22 00	22 26
40	19 32	20 04	20 45	21 11	21 36	21 59	22 23
45	19 49	20 25	21 13	21 17	21 38	21 58	22 18
S 50	20 10	20 53	21 53	21 23	21 41	21 57	22 14
52	20 20	21 06	22 17	21 26	21 42	21 56	22 11
54	20 31	21 22	22 49	21 30	21 43	21 56	22 09
56	20 44	21 42	////	21 33	21 45	21 55	22 06
58	20 59	22 07	////	21 37	21 46	21 55	22 03
S 60	21 17	22 42	////	21 42	21 48	21 54	22 00

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
7	05 56	06 09	12 06	14 32	02 10	03	10
8	06 22	06 35	12 07	15 13	02 53	04	16
9	06 47	07 00	12 07	15 54	03 34	05	23

UT	ARIES	VENUS −4.5		MARS +1.2		JUPITER −2.3		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
10 00	109 10.5	228 00.2	S17 15.7	171 39.0	S22 04.4	110 39.0	S 1 59.1	272 34.4	S 4 24.6
01	124 12.9	243 00.0	16.2	186 39.4	04.0	125 41.2	58.9	287 36.8	24.7
02	139 15.4	257 59.8	16.8	201 39.8	03.7	140 43.3	58.8	302 39.2	24.7
03	154 17.9	272 59.7	17.3	216 40.2	03.3	155 45.4	58.6	317 41.6	24.7
04	169 20.3	287 59.5	17.8	231 40.6	03.0	170 47.5	58.4	332 44.0	24.7
05	184 22.8	302 59.3	18.3	246 41.0	02.6	185 49.6	58.3	347 46.4	24.7
06	199 25.2	317 59.2	S17 18.9	261 41.4	S22 02.3	200 51.7	S 1 58.1	2 48.8	S 4 24.7
07	214 27.7	332 59.0	19.4	276 41.8	01.9	215 53.8	57.9	17 51.2	24.8
08	229 30.2	347 58.8	19.9	291 42.2	01.6	230 55.9	57.8	32 53.5	24.8
M 09	244 32.6	2 58.7	20.4	306 42.6	01.2	245 58.0	57.6	47 55.9	24.8
O 10	259 35.1	17 58.5	21.0	321 43.0	00.9	261 00.1	57.5	62 58.3	24.8
N 11	274 37.6	32 58.3	21.5	336 43.4	00.5	276 02.2	57.3	78 00.7	24.8
D 12	289 40.0	47 58.2	S17 22.0	351 43.8	S22 00.2	291 04.4	S 1 57.1	93 03.1	S 4 24.8
A 13	304 42.5	62 58.0	22.6	6 44.2	21 59.8	306 06.5	57.0	108 05.5	24.8
Y 14	319 45.0	77 57.8	23.1	21 44.6	59.5	321 08.6	56.8	123 07.9	24.9
15	334 47.4	92 57.6	23.6	36 45.0	59.1	336 10.7	56.6	138 10.3	24.9
16	349 49.9	107 57.5	24.1	51 45.4	58.7	351 12.8	56.5	153 12.7	24.9
17	4 52.3	122 57.3	24.7	66 45.8	58.4	6 14.9	56.3	168 15.1	24.9
18	19 54.8	137 57.1	S17 25.2	81 46.2	S21 58.0	21 17.0	S 1 56.2	183 17.5	S 4 24.9
19	34 57.3	152 56.9	25.7	96 46.6	57.7	36 19.1	56.0	198 19.9	24.9
20	49 59.7	167 56.7	26.2	111 47.0	57.3	51 21.2	55.8	213 22.3	25.0
21	65 02.2	182 56.6	26.7	126 47.4	57.0	66 23.3	55.7	228 24.7	25.0
22	80 04.7	197 56.4	27.3	141 47.8	56.6	81 25.4	55.5	243 27.1	25.0
23	95 07.1	212 56.2	27.8	156 48.2	56.2	96 27.5	55.3	258 29.5	25.0
11 00	110 09.6	227 56.0	S17 28.3	171 48.6	S21 55.9	111 29.6	S 1 55.2	273 31.9	S 4 25.0
01	125 12.1	242 55.8	28.8	186 49.0	55.5	126 31.7	55.0	288 34.3	25.0
02	140 14.5	257 55.6	29.4	201 49.4	55.2	141 33.9	54.8	303 36.7	25.0
03	155 17.0	272 55.5	29.9	216 49.8	54.8	156 36.0	54.7	318 39.1	25.1
04	170 19.5	287 55.3	30.4	231 50.2	54.4	171 38.1	54.5	333 41.5	25.1
05	185 21.9	302 55.1	30.9	246 50.6	54.1	186 40.2	54.3	348 43.9	25.1
06	200 24.4	317 54.9	S17 31.4	261 51.0	S21 53.7	201 42.3	S 1 54.2	3 46.3	S 4 25.1
07	215 26.8	332 54.7	32.0	276 51.4	53.4	216 44.4	54.0	18 48.7	25.1
T 08	230 29.3	347 54.5	32.5	291 51.8	53.0	231 46.5	53.8	33 51.1	25.1
U 09	245 31.8	2 54.3	33.0	306 52.2	52.6	246 48.6	53.7	48 53.4	25.1
E 10	260 34.2	17 54.1	33.5	321 52.6	52.3	261 50.7	53.5	63 55.8	25.2
S 11	275 36.7	32 53.9	34.0	336 53.0	51.9	276 52.8	53.4	78 58.2	25.2
D 12	290 39.2	47 53.7	S17 34.5	351 53.4	S21 51.5	291 54.9	S 1 53.2	94 00.6	S 4 25.2
A 13	305 41.6	62 53.5	35.1	6 53.8	51.2	306 57.0	53.0	109 03.0	25.2
Y 14	320 44.1	77 53.4	35.6	21 54.2	50.8	321 59.1	52.9	124 05.4	25.2
15	335 46.6	92 53.2	36.1	36 54.6	50.4	337 01.2	52.7	139 07.8	25.2
16	350 49.0	107 53.0	36.6	51 55.0	50.1	352 03.3	52.5	154 10.2	25.2
17	5 51.5	122 52.8	37.1	66 55.4	49.7	7 05.4	52.4	169 12.6	25.3
18	20 54.0	137 52.6	S17 37.6	81 55.8	S21 49.3	22 07.5	S 1 52.2	184 15.0	S 4 25.3
19	35 56.4	152 52.4	38.2	96 56.2	49.0	37 09.6	52.0	199 17.4	25.3
20	50 58.9	167 52.2	38.7	111 56.6	48.6	52 11.7	51.9	214 19.8	25.3
21	66 01.3	182 52.0	39.2	126 57.0	48.2	67 13.8	51.7	229 22.2	25.3
22	81 03.8	197 51.8	39.7	141 57.4	47.9	82 15.9	51.5	244 24.6	25.3
23	96 06.3	212 51.6	40.2	156 57.8	47.5	97 18.0	51.4	259 27.0	25.3
12 00	111 08.7	227 51.3	S17 40.7	171 58.2	S21 47.1	112 20.1	S 1 51.2	274 29.4	S 4 25.4
01	126 11.2	242 51.1	41.2	186 58.6	46.8	127 22.2	51.0	289 31.8	25.4
02	141 13.7	257 50.9	41.7	201 59.0	46.4	142 24.3	50.9	304 34.2	25.4
03	156 16.1	272 50.7	42.3	216 59.5	46.0	157 26.4	50.7	319 36.6	25.4
04	171 18.6	287 50.5	42.8	231 59.9	45.6	172 28.5	50.5	334 39.0	25.4
05	186 21.1	302 50.3	43.3	247 00.3	45.3	187 30.6	50.4	349 41.4	25.4
06	201 23.5	317 50.1	S17 43.8	262 00.7	S21 44.9	202 32.7	S 1 50.2	4 43.9	S 4 25.4
W 07	216 26.0	332 49.9	44.3	277 01.1	44.5	217 34.8	50.0	19 46.3	25.4
E 08	231 28.4	347 49.7	44.8	292 01.5	44.1	232 36.9	49.9	34 48.7	25.5
D 09	246 30.9	2 49.5	45.3	307 01.9	43.8	247 39.0	49.7	49 51.1	25.5
N 10	261 33.4	17 49.3	45.8	322 02.3	43.4	262 41.1	49.5	64 53.5	25.5
E 11	276 35.8	32 49.0	46.3	337 02.7	43.0	277 43.2	49.4	79 55.9	25.5
S 12	291 38.3	47 48.8	S17 46.9	352 03.1	S21 42.7	292 45.3	S 1 49.2	94 58.3	S 4 25.5
D 13	306 40.8	62 48.6	47.4	7 03.5	42.3	307 47.4	49.0	110 00.7	25.5
A 14	321 43.2	77 48.4	47.9	22 03.9	41.9	322 49.5	48.9	125 03.1	25.5
Y 15	336 45.7	92 48.2	48.4	37 04.3	41.5	337 51.6	48.7	140 05.5	25.5
16	351 48.2	107 48.0	48.9	52 04.7	41.1	352 53.7	48.5	155 07.9	25.6
17	6 50.6	122 47.7	49.4	67 05.1	40.8	7 55.8	48.4	170 10.3	25.6
18	21 53.1	137 47.5	S17 49.9	82 05.5	S21 40.4	22 57.9	S 1 48.2	185 12.7	S 4 25.6
19	36 55.6	152 47.3	50.4	97 05.9	40.0	38 00.0	48.0	200 15.1	25.6
20	51 58.0	167 47.1	50.9	112 06.3	39.6	53 02.1	47.8	215 17.5	25.6
21	67 00.5	182 46.9	51.4	127 06.7	39.3	68 04.2	47.7	230 19.9	25.6
22	82 02.9	197 46.6	51.9	142 07.1	38.9	83 06.3	47.5	245 22.3	25.6
23	97 05.4	212 46.4	52.4	157 07.5	38.5	98 08.4	47.3	260 24.7	25.6
	h m								
Mer. Pass.	16 36.6	*v* −0.2	*d* 0.5	*v* 0.4	*d* 0.4	*v* 2.1	*d* 0.2	*v* 2.4	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.8
Achernar	335 27.9	S57 11.1
Acrux	173 11.2	S63 09.5
Adhara	255 13.5	S28 59.3
Aldebaran	290 51.1	N16 31.9
Alioth	166 22.0	N55 53.6
Alkaid	153 00.2	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.5	S 8 42.5
Alphecca	126 12.7	N26 40.4
Alpheratz	357 45.4	N29 09.3
Altair	62 10.3	N 8 53.9
Ankaa	353 17.4	S42 14.9
Antares	112 28.7	S26 27.3
Arcturus	145 57.4	N19 07.3
Atria	107 32.6	S69 02.6
Avior	234 18.1	S59 32.7
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.8	N 7 24.5
Canopus	263 56.4	S52 42.2
Capella	280 36.6	N46 00.6
Deneb	49 33.2	N45 19.3
Denebola	182 35.3	N14 30.4
Diphda	348 57.6	S17 55.6
Dubhe	193 53.3	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.5	N51 29.2
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.9
Gacrux	172 02.8	S57 10.4
Gienah	175 54.0	S17 36.3
Hadar	148 50.6	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.5	S34 22.7
Kochab	137 20.3	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.7	N 4 08.0
Menkent	148 09.7	S36 25.4
Miaplacidus	221 39.3	S69 45.7
Mirfak	308 42.6	N49 54.2
Nunki	76 00.8	S26 16.9
Peacock	53 22.5	S56 42.0
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.7
Rasalhague	96 08.4	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.4	S 8 11.4
Rigil Kent.	139 54.4	S60 52.6
Sabik	102 14.8	S15 44.3
Schedar	349 42.7	N56 36.2
Shaula	96 24.7	S37 06.6
Sirius	258 34.9	S16 44.0
Spica	158 33.1	S11 13.2
Suhail	222 53.3	S43 28.7
Vega	80 40.6	N38 47.6
Zuben'ubi	137 07.5	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	117 46.4	8 48
Mars	61 39.0	12 32
Jupiter	1 20.0	16 32
Saturn	163 22.3	5 45

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
10 00	178 11.8	S22 02.3	118 12.0	16.5	N 1 44.3	12.0	54.1
01	193 11.5	01.9	132 47.5	16.5	1 56.3	12.1	54.1
02	208 11.3	01.5	147 23.0	16.5	2 08.4	12.1	54.1
03	223 11.0	01.2	161 58.5	16.5	2 20.5	12.0	54.1
04	238 10.8	00.8	176 34.0	16.4	2 32.5	12.1	54.1
05	253 10.5	00.4	191 09.4	16.5	2 44.6	12.0	54.1
06	268 10.3	S22 00.1	205 44.9	16.5	N 2 56.6	12.1	54.1
07	283 10.0	21 59.7	220 20.4	16.4	3 08.7	12.0	54.1
08	298 09.8	59.3	234 55.8	16.5	3 20.7	12.0	54.1
M 09	313 09.5	59.0	249 31.3	16.4	3 32.7	12.0	54.1
O 10	328 09.3	58.6	264 06.7	16.4	3 44.7	11.9	54.1
N 11	343 09.0	58.2	278 42.1	16.5	3 56.6	12.0	54.1
D 12	358 08.7	S21 57.8	293 17.6	16.3	N 4 08.6	11.9	54.2
A 13	13 08.5	57.5	307 52.9	16.4	4 20.5	12.0	54.2
Y 14	28 08.2	57.1	322 28.3	16.4	4 32.5	11.9	54.2
15	43 08.0	56.7	337 03.7	16.3	4 44.4	11.9	54.2
16	58 07.7	56.4	351 39.0	16.4	4 56.3	11.8	54.2
17	73 07.5	56.0	6 14.4	16.3	5 08.1	11.9	54.2
18	88 07.2	S21 55.6	20 49.7	16.3	N 5 20.0	11.8	54.2
19	103 07.0	55.2	35 25.0	16.3	5 31.8	11.8	54.2
20	118 06.7	54.9	50 00.3	16.2	5 43.6	11.8	54.2
21	133 06.5	54.5	64 35.5	16.2	5 55.4	11.8	54.2
22	148 06.2	54.1	79 10.7	16.2	6 07.2	11.8	54.2
23	163 06.0	53.7	93 45.9	16.2	6 19.0	11.7	54.2
11 00	178 05.7	S21 53.3	108 21.1	16.2	N 6 30.7	11.7	54.2
01	193 05.5	53.0	122 56.3	16.1	6 42.4	11.7	54.2
02	208 05.2	52.6	137 31.4	16.1	6 54.1	11.7	54.2
03	223 05.0	52.2	152 06.5	16.1	7 05.8	11.6	54.2
04	238 04.7	51.8	166 41.6	16.0	7 17.4	11.6	54.2
05	253 04.5	51.4	181 16.6	16.1	7 29.0	11.6	54.2
06	268 04.2	S21 51.0	195 51.7	15.9	N 7 40.6	11.6	54.2
07	283 04.0	50.7	210 26.6	16.0	7 52.2	11.5	54.2
T 08	298 03.7	50.3	225 01.6	15.9	8 03.7	11.5	54.2
U 09	313 03.5	49.9	239 36.5	15.9	8 15.2	11.5	54.3
E 10	328 03.2	49.5	254 11.4	15.8	8 26.7	11.4	54.3
S 11	343 03.0	49.1	268 46.2	15.9	8 38.1	11.5	54.3
D 12	358 02.7	S21 48.7	283 21.1	15.7	N 8 49.6	11.3	54.3
A 13	13 02.5	48.3	297 55.8	15.8	9 00.9	11.4	54.3
Y 14	28 02.2	47.9	312 30.6	15.7	9 12.3	11.3	54.3
15	43 02.0	47.5	327 05.3	15.6	9 23.6	11.3	54.3
16	58 01.7	47.2	341 39.9	15.7	9 34.9	11.3	54.3
17	73 01.5	46.8	356 14.6	15.5	9 46.2	11.2	54.3
18	88 01.3	S21 46.4	10 49.1	15.6	N 9 57.4	11.2	54.3
19	103 01.0	46.0	25 23.7	15.5	10 08.6	11.2	54.4
20	118 00.8	45.6	39 58.2	15.4	10 19.8	11.1	54.4
21	133 00.5	45.2	54 32.6	15.4	10 30.9	11.1	54.4
22	148 00.3	44.8	69 07.0	15.4	10 42.0	11.0	54.4
23	163 00.0	44.4	83 41.4	15.3	10 53.0	11.0	54.4
12 00	177 59.8	S21 44.0	98 15.7	15.3	N11 04.0	11.0	54.4
01	192 59.5	43.6	112 50.0	15.2	11 15.0	10.9	54.4
02	207 59.3	43.2	127 24.2	15.2	11 25.9	10.9	54.4
03	222 59.0	42.8	141 58.4	15.1	11 36.8	10.9	54.4
04	237 58.8	42.4	156 32.5	15.0	11 47.7	10.8	54.5
05	252 58.6	42.0	171 06.5	15.0	11 58.5	10.7	54.5
06	267 58.3	S21 41.6	185 40.5	15.0	N12 09.2	10.8	54.5
W 07	282 58.1	41.2	200 14.5	14.9	12 20.0	10.7	54.5
E 08	297 57.8	40.8	214 48.4	14.9	12 30.7	10.6	54.5
D 09	312 57.6	40.4	229 22.3	14.7	12 41.3	10.6	54.5
N 10	327 57.4	40.0	243 56.0	14.8	12 51.9	10.5	54.6
E 11	342 57.1	39.6	258 29.8	14.7	13 02.4	10.5	54.6
S 12	357 56.9	S21 39.2	273 03.5	14.6	N13 12.9	10.5	54.6
D 13	12 56.6	38.7	287 37.1	14.5	13 23.4	10.4	54.6
A 14	27 56.4	38.3	302 10.6	14.5	13 33.8	10.3	54.6
Y 15	42 56.1	37.9	316 44.1	14.5	13 44.1	10.3	54.6
16	57 55.9	37.5	331 17.6	14.4	13 54.4	10.3	54.7
17	72 55.7	37.1	345 51.0	14.3	14 04.7	10.2	54.7
18	87 55.4	S21 36.7	0 24.3	14.2	N14 14.9	10.1	54.7
19	102 55.2	36.3	14 57.5	14.2	14 25.0	10.1	54.7
20	117 54.9	35.9	29 30.7	14.1	14 35.1	10.1	54.7
21	132 54.7	35.5	44 03.8	14.1	14 45.2	10.0	54.7
22	147 54.5	35.0	58 36.9	14.0	14 55.2	9.9	54.8
23	162 54.2	34.6	73 09.9	13.9	N15 05.1	9.9	54.8
	SD 16.3	d 0.4	SD	14.8		14.8	14.9

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 10	Moonrise 11	Moonrise 12	Moonrise 13
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 10	10 09	▬	09 39	09 17	08 49	08 03
N 70	07 54	09 30	▬	09 43	09 28	09 11	08 46
68	07 41	09 03	10 54	09 47	09 38	09 28	09 16
66	07 30	08 42	10 05	09 51	09 46	09 42	09 38
64	07 20	08 25	09 35	09 54	09 53	09 54	09 55
62	07 12	08 11	09 12	09 56	09 59	10 03	10 10
60	07 05	08 00	08 54	09 58	10 04	10 12	10 22
N 58	06 58	07 49	08 39	10 00	10 09	10 19	10 33
56	06 52	07 40	08 26	10 02	10 13	10 26	10 42
54	06 47	07 32	08 14	10 04	10 17	10 32	10 50
52	06 42	07 25	08 04	10 05	10 20	10 37	10 58
50	06 37	07 18	07 56	10 06	10 23	10 42	11 05
45	06 27	07 04	07 37	10 09	10 30	10 53	11 19
N 40	06 18	06 51	07 21	10 12	10 36	11 02	11 31
35	06 09	06 41	07 08	10 14	10 41	11 09	11 41
30	06 01	06 31	06 57	10 16	10 45	11 16	11 50
20	05 46	06 14	06 37	10 19	10 52	11 28	12 06
N 10	05 32	05 58	06 20	10 22	10 59	11 38	12 20
0	05 16	05 42	06 04	10 25	11 05	11 48	12 33
S 10	04 58	05 25	05 48	10 27	11 12	11 58	12 46
20	04 37	05 06	05 30	10 30	11 19	12 08	13 00
30	04 10	04 43	05 10	10 34	11 26	12 20	13 16
35	03 53	04 29	04 58	10 36	11 31	12 27	13 25
40	03 32	04 12	04 44	10 38	11 36	12 35	13 36
45	03 04	03 51	04 27	10 41	11 42	12 45	13 48
S 50	02 24	03 24	04 07	10 44	11 49	12 56	14 04
52	02 02	03 11	03 57	10 45	11 53	13 01	14 11
54	01 31	02 55	03 46	10 47	11 56	13 07	14 19
56	00 27	02 36	03 34	10 49	12 01	13 14	14 28
58	////	02 13	03 19	10 51	12 05	13 21	14 39
S 60	////	01 39	03 01	10 53	12 10	13 29	14 51

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 10	Moonset 11	Moonset 12	Moonset 13
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	14 08	16 06	24 08	00 08	02 03	04 21
N 70	▬	14 47	16 23	23 58	25 43	01 43	03 39
68	13 22	15 14	16 36	23 51	25 27	01 27	03 11
66	14 11	15 34	16 47	23 44	25 15	01 15	02 50
64	14 41	15 51	16 56	23 39	25 04	01 04	02 33
62	15 04	16 05	17 04	23 34	24 55	00 55	02 19
60	15 22	16 17	17 11	23 30	24 48	00 48	02 08
N 58	15 37	16 27	17 18	23 26	24 41	00 41	01 58
56	15 50	16 36	17 24	23 23	24 35	00 35	01 49
54	16 02	16 44	17 29	23 20	24 30	00 30	01 41
52	16 12	16 51	17 34	23 18	24 25	00 25	01 34
50	16 20	16 58	17 39	23 15	24 21	00 21	01 28
45	16 39	17 12	17 49	23 10	24 12	00 12	01 15
N 40	16 54	17 24	17 58	23 06	24 04	00 04	01 04
35	17 07	17 35	18 06	23 02	23 58	24 55	00 55
30	17 19	17 45	18 14	22 59	23 52	24 47	00 47
20	17 38	18 02	18 29	22 54	23 42	24 33	00 33
N 10	17 55	18 18	18 44	22 49	23 34	24 20	00 20
0	18 12	18 34	19 00	22 44	23 26	24 09	00 09
S 10	18 28	18 50	19 17	22 40	23 18	23 58	24 41
20	18 45	19 09	19 38	22 35	23 09	23 46	24 26
30	19 06	19 32	20 05	22 29	22 59	23 32	24 08
35	19 17	19 46	20 22	22 26	22 54	23 24	23 58
40	19 31	20 03	20 43	22 23	22 47	23 15	23 46
45	19 48	20 24	21 11	22 18	22 40	23 04	23 33
S 50	20 08	20 50	21 50	22 14	22 31	22 52	23 16
52	20 18	21 04	22 12	22 11	22 27	22 46	23 08
54	20 29	21 19	22 42	22 09	22 23	22 39	23 00
56	20 41	21 38	23 38	22 06	22 18	22 32	22 50
58	20 56	22 01	////	22 03	22 12	22 24	22 39
S 60	21 13	22 33	////	22 00	22 06	22 15	22 27

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
10	07 12	07 25	12 07	16 34	04 14	06	32
11	07 37	07 49	12 08	17 15	04 55	07	41
12	08 00	08 12	12 08	17 58	05 37	08	50

UT	ARIES	VENUS −4.5		MARS +1.2		JUPITER −2.3		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
13 00	112 07.9	227 46.2	S17 52.9	172 07.9	S21 38.1	113 10.5	S 1 47.2	275 27.1	S 4 25.7
01	127 10.3	242 46.0	53.4	187 08.4	37.7	128 12.6	47.0	290 29.5	25.7
02	142 12.8	257 45.7	53.9	202 08.8	37.4	143 14.7	46.8	305 31.9	25.7
03	157 15.3	272 45.5	54.4	217 09.2	37.0	158 16.8	46.7	320 34.3	25.7
04	172 17.7	287 45.3	54.9	232 09.6	36.6	173 18.9	46.5	335 36.7	25.7
05	187 20.2	302 45.1	55.4	247 10.0	36.2	188 21.0	46.3	350 39.1	25.7
06	202 22.7	317 44.8	S17 55.9	262 10.4	S21 35.8	203 23.1	S 1 46.2	5 41.5	S 4 25.7
07	217 25.1	332 44.6	56.4	277 10.8	35.4	218 25.2	46.0	20 43.9	25.7
T 08	232 27.6	347 44.4	56.9	292 11.2	35.1	233 27.2	45.8	35 46.4	25.7
H 09	247 30.1	2 44.1	57.4	307 11.6	34.7	248 29.3	45.7	50 48.8	25.8
U 10	262 32.5	17 43.9	57.9	322 12.0	34.3	263 31.4	45.5	65 51.2	25.8
R 11	277 35.0	32 43.7	58.4	337 12.4	33.9	278 33.5	45.3	80 53.6	25.8
S 12	292 37.4	47 43.4	S17 58.9	352 12.8	S21 33.5	293 35.6	S 1 45.1	95 56.0	S 4 25.8
D 13	307 39.9	62 43.2	59.4	7 13.2	33.1	308 37.7	45.0	110 58.4	25.8
A 14	322 42.4	77 43.0	17 59.9	22 13.6	32.8	323 39.8	44.8	126 00.8	25.8
Y 15	337 44.8	92 42.7	18 00.4	37 14.0	32.4	338 41.9	44.6	141 03.2	25.8
16	352 47.3	107 42.5	00.9	52 14.5	32.0	353 44.0	44.5	156 05.6	25.8
17	7 49.8	122 42.2	01.4	67 14.9	31.6	8 46.1	44.3	171 08.0	25.8
18	22 52.2	137 42.0	S18 01.9	82 15.3	S21 31.2	23 48.2	S 1 44.1	186 10.4	S 4 25.9
19	37 54.7	152 41.8	02.4	97 15.7	30.8	38 50.3	44.0	201 12.8	25.9
20	52 57.2	167 41.5	02.9	112 16.1	30.4	53 52.4	43.8	216 15.2	25.9
21	67 59.6	182 41.3	03.4	127 16.5	30.0	68 54.5	43.6	231 17.7	25.9
22	83 02.1	197 41.0	03.9	142 16.9	29.7	83 56.5	43.4	246 20.1	25.9
23	98 04.5	212 40.8	04.4	157 17.3	29.3	98 58.6	43.3	261 22.5	25.9
14 00	113 07.0	227 40.5	S18 04.9	172 17.7	S21 28.9	114 00.7	S 1 43.1	276 24.9	S 4 25.9
01	128 09.5	242 40.3	05.4	187 18.1	28.5	129 02.8	42.9	291 27.3	25.9
02	143 11.9	257 40.1	05.9	202 18.5	28.1	144 04.9	42.8	306 29.7	25.9
03	158 14.4	272 39.8	06.4	217 19.0	27.7	159 07.0	42.6	321 32.1	25.9
04	173 16.9	287 39.6	06.9	232 19.4	27.3	174 09.1	42.4	336 34.5	26.0
05	188 19.3	302 39.3	07.4	247 19.8	26.9	189 11.2	42.3	351 36.9	26.0
06	203 21.8	317 39.1	S18 07.9	262 20.2	S21 26.5	204 13.3	S 1 42.1	6 39.3	S 4 26.0
07	218 24.3	332 38.8	08.3	277 20.6	26.1	219 15.4	41.9	21 41.7	26.0
08	233 26.7	347 38.6	08.8	292 21.0	25.7	234 17.5	41.7	36 44.2	26.0
F 09	248 29.2	2 38.3	09.3	307 21.4	25.3	249 19.5	41.6	51 46.6	26.0
R 10	263 31.7	17 38.1	09.8	322 21.8	24.9	264 21.6	41.4	66 49.0	26.0
I 11	278 34.1	32 37.8	10.3	337 22.2	24.6	279 23.7	41.2	81 51.4	26.0
D 12	293 36.6	47 37.5	S18 10.8	352 22.6	S21 24.2	294 25.8	S 1 41.1	96 53.8	S 4 26.0
A 13	308 39.0	62 37.3	11.3	7 23.1	23.8	309 27.9	40.9	111 56.2	26.0
Y 14	323 41.5	77 37.0	11.8	22 23.5	23.4	324 30.0	40.7	126 58.6	26.0
15	338 44.0	92 36.8	12.3	37 23.9	23.0	339 32.1	40.5	142 01.0	26.1
16	353 46.4	107 36.5	12.7	52 24.3	22.6	354 34.2	40.4	157 03.4	26.1
17	8 48.9	122 36.3	13.2	67 24.7	22.2	9 36.3	40.2	172 05.9	26.1
18	23 51.4	137 36.0	S18 13.7	82 25.1	S21 21.8	24 38.3	S 1 40.0	187 08.3	S 4 26.1
19	38 53.8	152 35.7	14.2	97 25.5	21.4	39 40.4	39.8	202 10.7	26.1
20	53 56.3	167 35.5	14.7	112 25.9	21.0	54 42.5	39.7	217 13.1	26.1
21	68 58.8	182 35.2	15.2	127 26.3	20.6	69 44.6	39.5	232 15.5	26.1
22	84 01.2	197 35.0	15.7	142 26.8	20.2	84 46.7	39.3	247 17.9	26.1
23	99 03.7	212 34.7	16.1	157 27.2	19.8	99 48.8	39.2	262 20.3	26.1
15 00	114 06.2	227 34.4	S18 16.6	172 27.6	S21 19.4	114 50.9	S 1 39.0	277 22.7	S 4 26.1
01	129 08.6	242 34.2	17.1	187 28.0	19.0	129 52.9	38.8	292 25.2	26.1
02	144 11.1	257 33.9	17.6	202 28.4	18.6	144 55.0	38.6	307 27.6	26.1
03	159 13.5	272 33.6	18.1	217 28.8	18.2	159 57.1	38.5	322 30.0	26.2
04	174 16.0	287 33.4	18.6	232 29.2	17.8	174 59.2	38.3	337 32.4	26.2
05	189 18.5	302 33.1	19.0	247 29.6	17.4	190 01.3	38.1	352 34.8	26.2
06	204 20.9	317 32.8	S18 19.5	262 30.1	S21 17.0	205 03.4	S 1 38.0	7 37.2	S 4 26.2
07	219 23.4	332 32.5	20.0	277 30.5	16.6	220 05.5	37.8	22 39.6	26.2
S 08	234 25.9	347 32.3	20.5	292 30.9	16.2	235 07.5	37.6	37 42.1	26.2
A 09	249 28.3	2 32.0	21.0	307 31.3	15.8	250 09.6	37.4	52 44.5	26.2
T 10	264 30.8	17 31.7	21.4	322 31.7	15.4	265 11.7	37.3	67 46.9	26.2
U 11	279 33.3	32 31.5	21.9	337 32.1	15.0	280 13.8	37.1	82 49.3	26.2
R 12	294 35.7	47 31.2	S18 22.4	352 32.5	S21 14.5	295 15.9	S 1 36.9	97 51.7	S 4 26.2
D 13	309 38.2	62 30.9	22.9	7 33.0	14.1	310 18.0	36.7	112 54.1	26.2
A 14	324 40.7	77 30.6	23.3	22 33.4	13.7	325 20.1	36.6	127 56.5	26.2
Y 15	339 43.1	92 30.4	23.8	37 33.8	13.3	340 22.1	36.4	142 59.0	26.2
16	354 45.6	107 30.1	24.3	52 34.2	12.9	355 24.2	36.2	158 01.4	26.3
17	9 48.0	122 29.8	24.8	67 34.6	12.5	10 26.3	36.0	173 03.8	26.3
18	24 50.5	137 29.5	S18 25.2	82 35.0	S21 12.1	25 28.4	S 1 35.9	188 06.2	S 4 26.3
19	39 53.0	152 29.2	25.7	97 35.4	11.7	40 30.5	35.7	203 08.6	26.3
20	54 55.4	167 29.0	26.2	112 35.9	11.3	55 32.5	35.5	218 11.0	26.3
21	69 57.9	182 28.7	26.7	127 36.3	10.9	70 34.6	35.3	233 13.5	26.3
22	85 00.4	197 28.4	27.1	142 36.7	10.5	85 36.7	35.2	248 15.9	26.3
23	100 02.8	212 28.1	27.6	157 37.1	10.1	100 38.8	35.0	263 18.3	26.3
	h m								
Mer. Pass.	16 24.8	v −0.3	d 0.5	v 0.4	d 0.4	v 2.1	d 0.2	v 2.4	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.8
Achernar	335 27.9	S57 11.1
Acrux	173 11.1	S63 09.5
Adhara	255 13.5	S28 59.4
Aldebaran	290 51.1	N16 31.9
Alioth	166 22.0	N55 53.6
Alkaid	153 00.2	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.5	S 8 42.5
Alphecca	126 12.6	N26 40.4
Alpheratz	357 45.5	N29 09.3
Altair	62 10.3	N 8 53.9
Ankaa	353 17.4	S42 14.9
Antares	112 28.7	S26 27.3
Arcturus	145 57.3	N19 07.3
Atria	107 32.5	S69 02.6
Avior	234 18.1	S59 32.7
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.8	N 7 24.5
Canopus	263 56.4	S52 42.2
Capella	280 36.6	N46 00.6
Deneb	49 33.2	N45 19.3
Denebola	182 35.2	N14 30.4
Diphda	348 57.7	S17 55.6
Dubhe	193 53.2	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.4	N51 29.1
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.9
Gacrux	172 02.8	S57 10.4
Gienah	175 54.0	S17 36.3
Hadar	148 50.6	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.5	S34 22.7
Kochab	137 20.2	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.7	N 4 08.0
Menkent	148 09.7	S36 25.4
Miaplacidus	221 39.3	S69 45.7
Mirfak	308 42.6	N49 54.2
Nunki	76 00.8	S26 16.9
Peacock	53 22.5	S56 42.0
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.4	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.4	S 8 11.4
Rigil Kent.	139 54.4	S60 52.6
Sabik	102 14.8	S15 44.3
Schedar	349 42.7	N56 36.2
Shaula	96 24.6	S37 06.6
Sirius	258 34.9	S16 44.0
Spica	158 33.1	S11 13.2
Suhail	222 53.3	S43 28.7
Vega	80 40.6	N38 47.6
Zuben'ubi	137 07.5	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	114 33.5	8 49
Mars	59 10.7	12 30
Jupiter	0 53.7	16 22
Saturn	163 17.9	5 33

UT	SUN			MOON						
	GHA		Dec	GHA	v		Dec	d	HP	
d h	° ′		° ′	° ′	′		° ′	′	′	
13 00	177 54.0		S21 34.2	87 42.8	13.9		N15 15.0	9.8	54.8	
01	192 53.8		33.8	102 15.7	13.7		15 24.8	9.8	54.8	
02	207 53.5		33.4	116 48.4	13.8		15 34.6	9.7	54.8	
03	222 53.3	. .	33.0	131 21.2	13.6		15 44.3	9.6	54.9	
04	237 53.0		32.6	145 53.8	13.6		15 53.9	9.6	54.9	
05	252 52.8		32.1	160 26.4	13.5		16 03.5	9.5	54.9	
06	267 52.6		S21 31.7	174 58.9	13.4		N16 13.0	9.5	54.9	
07	282 52.3		31.3	189 31.3	13.4		16 22.5	9.4	54.9	
T 08	297 52.1		30.9	204 03.7	13.2		16 31.9	9.3	55.0	
H 09	312 51.9	. .	30.4	218 35.9	13.3		16 41.2	9.3	55.0	
U 10	327 51.6		30.0	233 08.2	13.1		16 50.5	9.2	55.0	
R 11	342 51.4		29.6	247 40.3	13.0		16 59.7	9.1	55.0	
S 12	357 51.2		S21 29.2	262 12.3	13.0		N17 08.8	9.0	55.1	
D 13	12 50.9		28.8	276 44.3	12.9		17 17.8	9.0	55.1	
A 14	27 50.7		28.3	291 16.2	12.9		17 26.8	9.0	55.1	
Y 15	42 50.5	. .	27.9	305 48.1	12.7		17 35.8	8.8	55.1	
16	57 50.2		27.5	320 19.8	12.7		17 44.6	8.8	55.2	
17	72 50.0		27.0	334 51.5	12.6		17 53.4	8.7	55.2	
18	87 49.8		S21 26.6	349 23.1	12.5		N18 02.1	8.6	55.2	
19	102 49.5		26.2	3 54.6	12.4		18 10.7	8.6	55.2	
20	117 49.3		25.8	18 26.0	12.3		18 19.3	8.5	55.3	
21	132 49.1	. .	25.3	32 57.3	12.3		18 27.8	8.4	55.3	
22	147 48.8		24.9	47 28.6	12.2		18 36.2	8.3	55.3	
23	162 48.6		24.5	61 59.8	12.1		18 44.5	8.3	55.3	
14 00	177 48.4		S21 24.0	76 30.9	12.0		N18 52.8	8.2	55.4	
01	192 48.1		23.6	91 01.9	11.9		19 01.0	8.1	55.4	
02	207 47.9		23.2	105 32.8	11.9		19 09.1	8.0	55.4	
03	222 47.7	. .	22.7	120 03.7	11.8		19 17.1	7.9	55.4	
04	237 47.4		22.3	134 34.5	11.6		19 25.0	7.9	55.5	
05	252 47.2		21.9	149 05.1	11.6		19 32.9	7.7	55.5	
06	267 47.0		S21 21.4	163 35.7	11.5		N19 40.6	7.7	55.5	
07	282 46.8		21.0	178 06.2	11.5		19 48.3	7.6	55.6	
08	297 46.5		20.5	192 36.7	11.3		19 55.9	7.5	55.6	
F 09	312 46.3	. .	20.1	207 07.0	11.3		20 03.4	7.4	55.6	
R 10	327 46.1		19.7	221 37.3	11.1		20 10.8	7.3	55.6	
I 11	342 45.8		19.2	236 07.4	11.1		20 18.1	7.2	55.7	
D 12	357 45.6		S21 18.8	250 37.5	11.0		N20 25.3	7.2	55.7	
A 13	12 45.4		18.3	265 07.5	10.9		20 32.5	7.0	55.7	
Y 14	27 45.2		17.9	279 37.4	10.8		20 39.5	7.0	55.8	
15	42 44.9	. .	17.5	294 07.2	10.8		20 46.5	6.8	55.8	
16	57 44.7		17.0	308 37.0	10.6		20 53.3	6.8	55.8	
17	72 44.5		16.6	323 06.6	10.6		21 00.1	6.7	55.8	
18	87 44.3		S21 16.1	337 36.2	10.4		N21 06.8	6.5	55.9	
19	102 44.0		15.7	352 05.6	10.4		21 13.3	6.5	55.9	
20	117 43.8		15.2	6 35.0	10.3		21 19.8	6.4	55.9	
21	132 43.6	. .	14.8	21 04.3	10.2		21 26.2	6.2	56.0	
22	147 43.4		14.3	35 33.5	10.2		21 32.4	6.2	56.0	
23	162 43.1		13.9	50 02.7	10.0		21 38.6	6.1	56.0	
15 00	177 42.9		S21 13.4	64 31.7	9.9		N21 44.7	5.9	56.1	
01	192 42.7		13.0	79 00.6	9.9		21 50.6	5.9	56.1	
02	207 42.5		12.5	93 29.5	9.8		21 56.5	5.7	56.1	
03	222 42.2	. .	12.1	107 58.3	9.7		22 02.2	5.6	56.2	
04	237 42.0		11.6	122 27.0	9.6		22 07.8	5.6	56.2	
05	252 41.8		11.2	136 55.6	9.5		22 13.4	5.4	56.2	
06	267 41.6		S21 10.7	151 24.1	9.4		N22 18.8	5.3	56.3	
07	282 41.3		10.3	165 52.5	9.4		22 24.1	5.2	56.3	
S 08	297 41.1		09.8	180 20.9	9.2		22 29.3	5.0	56.3	
A 09	312 40.9	. .	09.4	194 49.1	9.2		22 34.3	5.0	56.4	
T 10	327 40.7		08.9	209 17.3	9.1		22 39.3	4.8	56.4	
U 11	342 40.5		08.4	223 45.4	9.0		22 44.1	4.8	56.4	
R 12	357 40.2		S21 08.0	238 13.4	8.9		N22 48.9	4.6	56.5	
D 13	12 40.0		07.5	252 41.3	8.8		22 53.5	4.5	56.5	
A 14	27 39.8		07.1	267 09.1	8.8		22 58.0	4.4	56.5	
Y 15	42 39.6	. .	06.6	281 36.9	8.7		23 02.4	4.2	56.6	
16	57 39.4		06.1	296 04.6	8.6		23 06.6	4.1	56.6	
17	72 39.1		05.7	310 32.2	8.5		23 10.7	4.0	56.6	
18	87 38.9		S21 05.2	324 59.7	8.4		N23 14.7	3.9	56.7	
19	102 38.7		04.8	339 27.1	8.4		23 18.6	3.8	56.7	
20	117 38.5		04.3	353 54.5	8.2		23 22.4	3.6	56.7	
21	132 38.3	. .	03.8	8 21.7	8.2		23 26.0	3.5	56.8	
22	147 38.1		03.4	22 48.9	8.2		23 29.5	3.4	56.8	
23	162 37.8		02.9	37 16.1	8.0		N23 32.9	3.3	56.8	
	SD 16.3		d 0.4	SD	15.0		15.2		15.4	

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 13	Moonrise 14	Moonrise 15	Moonrise 16
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 04	09 57	▬	08 03	▭	▭	▭
N 70	07 48	09 22	▬	08 46	07 44	▭	▭
68	07 36	08 56	10 39	09 16	08 56	▭	▭
66	07 26	08 37	09 57	09 38	09 33	09 28	09 19
64	07 17	08 21	09 29	09 55	10 00	10 10	10 35
62	07 09	08 08	09 07	10 10	10 20	10 38	11 12
60	07 02	07 56	08 50	10 22	10 37	11 00	11 38
N 58	06 56	07 47	08 35	10 33	10 51	11 18	11 59
56	06 50	07 38	08 23	10 42	11 04	11 33	12 16
54	06 45	07 30	08 12	10 50	11 14	11 46	12 30
52	06 41	07 23	08 02	10 58	11 24	11 58	12 43
50	06 36	07 17	07 54	11 05	11 32	12 08	12 54
45	06 26	07 03	07 35	11 19	11 51	12 29	13 17
N 40	06 17	06 51	07 21	11 31	12 05	12 47	13 36
35	06 09	06 40	07 08	11 41	12 18	13 01	13 52
30	06 02	06 31	06 57	11 50	12 29	13 14	14 05
20	05 47	06 14	06 38	12 06	12 48	13 36	14 29
N 10	05 33	05 59	06 21	12 20	13 05	13 55	14 49
0	05 17	05 43	06 05	12 33	13 21	14 12	15 08
S 10	05 00	05 27	05 49	12 46	13 36	14 30	15 26
20	04 40	05 08	05 32	13 00	13 53	14 49	15 47
30	04 13	04 46	05 12	13 16	14 13	15 11	16 10
35	03 56	04 32	05 01	13 25	14 24	15 24	16 24
40	03 36	04 15	04 47	13 36	14 37	15 40	16 40
45	03 09	03 55	04 31	13 48	14 53	15 57	16 59
S 50	02 31	03 29	04 11	14 04	15 12	16 20	17 23
52	02 10	03 16	04 02	14 11	15 22	16 30	17 34
54	01 42	03 01	03 51	14 19	15 32	16 43	17 47
56	00 55	02 43	03 39	14 28	15 44	16 57	18 02
58	////	02 21	03 25	14 39	15 57	17 13	18 20
S 60	////	01 51	03 08	14 51	16 13	17 32	18 41

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 13	Moonset 14	Moonset 15	Moonset 16
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	14 22	16 15	04 21	▭	▭	▭
N 70	▬	14 57	16 30	03 39	06 19	▭	▭
68	13 39	15 22	16 43	03 11	05 08	▭	▭
66	14 22	15 42	16 53	02 50	04 31	06 22	08 24
64	14 50	15 58	17 02	02 33	04 06	05 40	07 08
62	15 11	16 11	17 09	02 19	03 46	05 12	06 31
60	15 29	16 22	17 16	02 08	03 29	04 51	06 05
N 58	15 43	16 32	17 22	01 58	03 16	04 33	05 45
56	15 56	16 40	17 28	01 49	03 04	04 18	05 28
54	16 06	16 48	17 33	01 41	02 54	04 06	05 13
52	16 16	16 55	17 38	01 34	02 45	03 54	05 01
50	16 25	17 02	17 42	01 28	02 37	03 45	04 50
45	16 43	17 16	17 52	01 15	02 19	03 24	04 27
N 40	16 58	17 27	18 01	01 04	02 05	03 07	04 08
35	17 10	17 38	18 09	00 55	01 53	02 53	03 53
30	17 21	17 47	18 17	00 47	01 43	02 41	03 40
20	17 40	18 04	18 31	00 33	01 25	02 20	03 17
N 10	17 57	18 19	18 45	00 20	01 10	02 02	02 57
0	18 13	18 35	19 01	00 09	00 55	01 45	02 38
S 10	18 28	18 51	19 18	24 41	00 41	01 28	02 20
20	18 45	19 10	19 38	24 26	00 26	01 10	02 00
30	19 05	19 32	20 04	24 08	00 08	00 50	01 37
35	19 17	19 46	20 21	23 58	24 37	00 37	01 24
40	19 30	20 02	20 42	23 46	24 24	00 24	01 09
45	19 46	20 22	21 08	23 33	24 07	00 07	00 50
S 50	20 06	20 48	21 46	23 16	23 47	24 27	00 27
52	20 15	21 00	22 06	23 08	23 38	24 17	00 17
54	20 26	21 15	22 34	23 00	23 27	24 04	00 04
56	20 38	21 33	23 18	22 50	23 15	23 50	24 40
58	20 52	21 55	////	22 39	23 01	23 34	24 22
S 60	21 08	22 24	////	22 27	22 45	23 14	24 01

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
13	08 24	08 35	12 09	18 44	06 21	09	60
14	08 46	08 57	12 09	19 33	07 08	10	69
15	09 08	09 19	12 09	20 25	07 59	11	78

UT	ARIES	VENUS −4.5		MARS +1.1		JUPITER −2.2		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
16 00	115 05.3	227 27.8	S18 28.1	172 37.5	S21 09.7	115 40.9	S 1 34.8	278 20.7	S 4 26.3
01	130 07.8	242 27.5	28.6	187 37.9	09.2	130 43.0	34.6	293 23.1	26.3
02	145 10.2	257 27.3	29.0	202 38.3	08.8	145 45.0	34.5	308 25.5	26.3
03	160 12.7	272 27.0	29.5	217 38.8	08.4	160 47.1	34.3	323 28.0	26.3
04	175 15.2	287 26.7	30.0	232 39.2	08.0	175 49.2	34.1	338 30.4	26.3
05	190 17.6	302 26.4	30.4	247 39.6	07.6	190 51.3	33.9	353 32.8	26.3
06	205 20.1	317 26.1	S18 30.9	262 40.0	S21 07.2	205 53.4	S 1 33.8	8 35.2	S 4 26.3
07	220 22.5	332 25.8	31.4	277 40.4	06.8	220 55.4	33.6	23 37.6	26.4
08	235 25.0	347 25.5	31.9	292 40.8	06.4	235 57.5	33.4	38 40.0	26.4
S 09	250 27.5	2 25.2	32.3	307 41.3	05.9	250 59.6	33.2	53 42.5	26.4
U 10	265 29.9	17 24.9	32.8	322 41.7	05.5	266 01.7	33.1	68 44.9	26.4
N 11	280 32.4	32 24.7	33.3	337 42.1	05.1	281 03.8	32.9	83 47.3	26.4
D 12	295 34.9	47 24.4	S18 33.7	352 42.5	S21 04.7	296 05.8	S 1 32.7	98 49.7	S 4 26.4
A 13	310 37.3	62 24.1	34.2	7 42.9	04.3	311 07.9	32.5	113 52.1	26.4
Y 14	325 39.8	77 23.8	34.7	22 43.3	03.9	326 10.0	32.4	128 54.6	26.4
15	340 42.3	92 23.5	35.1	37 43.8	03.5	341 12.1	32.2	143 57.0	26.4
16	355 44.7	107 23.2	35.6	52 44.2	03.0	356 14.2	32.0	158 59.4	26.4
17	10 47.2	122 22.9	36.0	67 44.6	02.6	11 16.2	31.8	174 01.8	26.4
18	25 49.6	137 22.6	S18 36.5	82 45.0	S21 02.2	26 18.3	S 1 31.7	189 04.2	S 4 26.4
19	40 52.1	152 22.3	37.0	97 45.4	01.8	41 20.4	31.5	204 06.7	26.4
20	55 54.6	167 22.0	37.4	112 45.9	01.4	56 22.5	31.3	219 09.1	26.4
21	70 57.0	182 21.7	37.9	127 46.3	00.9	71 24.6	31.1	234 11.5	26.4
22	85 59.5	197 21.4	38.4	142 46.7	00.5	86 26.6	31.0	249 13.9	26.4
23	101 02.0	212 21.1	38.8	157 47.1	21 00.1	101 28.7	30.8	264 16.3	26.4
17 00	116 04.4	227 20.8	S18 39.3	172 47.5	S20 59.7	116 30.8	S 1 30.6	279 18.8	S 4 26.4
01	131 06.9	242 20.5	39.7	187 47.9	59.3	131 32.9	30.4	294 21.2	26.5
02	146 09.4	257 20.2	40.2	202 48.4	58.8	146 34.9	30.3	309 23.6	26.5
03	161 11.8	272 19.9	40.7	217 48.8	58.4	161 37.0	30.1	324 26.0	26.5
04	176 14.3	287 19.6	41.1	232 49.2	58.0	176 39.1	29.9	339 28.5	26.5
05	191 16.8	302 19.3	41.6	247 49.6	57.6	191 41.2	29.7	354 30.9	26.5
06	206 19.2	317 18.9	S18 42.0	262 50.0	S20 57.2	206 43.2	S 1 29.6	9 33.3	S 4 26.5
07	221 21.7	332 18.6	42.5	277 50.5	56.7	221 45.3	29.4	24 35.7	26.5
08	236 24.1	347 18.3	42.9	292 50.9	56.3	236 47.4	29.2	39 38.1	26.5
M 09	251 26.6	2 18.0	43.4	307 51.3	55.9	251 49.5	29.0	54 40.6	26.5
O 10	266 29.1	17 17.7	43.9	322 51.7	55.5	266 51.5	28.8	69 43.0	26.5
N 11	281 31.5	32 17.4	44.3	337 52.1	55.0	281 53.6	28.7	84 45.4	26.5
D 12	296 34.0	47 17.1	S18 44.8	352 52.6	S20 54.6	296 55.7	S 1 28.5	99 47.8	S 4 26.5
A 13	311 36.5	62 16.8	45.2	7 53.0	54.2	311 57.8	28.3	114 50.3	26.5
Y 14	326 38.9	77 16.5	45.7	22 53.4	53.8	326 59.8	28.1	129 52.7	26.5
15	341 41.4	92 16.1	46.1	37 53.8	53.3	342 01.9	28.0	144 55.1	26.5
16	356 43.9	107 15.8	46.6	52 54.3	52.9	357 04.0	27.8	159 57.5	26.5
17	11 46.3	122 15.5	47.0	67 54.7	52.5	12 06.1	27.6	175 00.0	26.5
18	26 48.8	137 15.2	S18 47.5	82 55.1	S20 52.1	27 08.1	S 1 27.4	190 02.4	S 4 26.5
19	41 51.3	152 14.9	47.9	97 55.5	51.6	42 10.2	27.2	205 04.8	26.5
20	56 53.7	167 14.6	48.4	112 55.9	51.2	57 12.3	27.1	220 07.2	26.5
21	71 56.2	182 14.2	48.8	127 56.4	50.8	72 14.4	26.9	235 09.6	26.5
22	86 58.6	197 13.9	49.3	142 56.8	50.3	87 16.4	26.7	250 12.1	26.5
23	102 01.1	212 13.6	49.7	157 57.2	49.9	102 18.5	26.5	265 14.5	26.5
18 00	117 03.6	227 13.3	S18 50.2	172 57.6	S20 49.5	117 20.6	S 1 26.4	280 16.9	S 4 26.5
01	132 06.0	242 13.0	50.6	187 58.0	49.1	132 22.7	26.2	295 19.3	26.5
02	147 08.5	257 12.6	51.1	202 58.5	48.6	147 24.7	26.0	310 21.8	26.5
03	162 11.0	272 12.3	51.5	217 58.9	48.2	162 26.8	25.8	325 24.2	26.6
04	177 13.4	287 12.0	52.0	232 59.3	47.8	177 28.9	25.6	340 26.6	26.6
05	192 15.9	302 11.7	52.4	247 59.7	47.3	192 30.9	25.5	355 29.1	26.6
06	207 18.4	317 11.3	S18 52.8	263 00.2	S20 46.9	207 33.0	S 1 25.3	10 31.5	S 4 26.6
07	222 20.8	332 11.0	53.3	278 00.6	46.5	222 35.1	25.1	25 33.9	26.6
T 08	237 23.3	347 10.7	53.7	293 01.0	46.0	237 37.2	24.9	40 36.3	26.6
U 09	252 25.8	2 10.4	54.2	308 01.4	45.6	252 39.2	24.7	55 38.8	26.6
E 10	267 28.2	17 10.0	54.6	323 01.9	45.2	267 41.3	24.6	70 41.2	26.6
S 11	282 30.7	32 09.7	55.1	338 02.3	44.7	282 43.4	24.4	85 43.6	26.6
D 12	297 33.1	47 09.4	S18 55.5	353 02.7	S20 44.3	297 45.4	S 1 24.2	100 46.0	S 4 26.6
A 13	312 35.6	62 09.0	55.9	8 03.1	43.9	312 47.5	24.0	115 48.5	26.6
Y 14	327 38.1	77 08.7	56.4	23 03.6	43.4	327 49.6	23.9	130 50.9	26.6
15	342 40.5	92 08.4	56.8	38 04.0	43.0	342 51.6	23.7	145 53.3	26.6
16	357 43.0	107 08.0	57.3	53 04.4	42.6	357 53.7	23.5	160 55.8	26.6
17	12 45.5	122 07.7	57.7	68 04.8	42.1	12 55.8	23.3	175 58.2	26.6
18	27 47.9	137 07.4	S18 58.1	83 05.3	S20 41.7	27 57.9	S 1 23.1	191 00.6	S 4 26.6
19	42 50.4	152 07.0	58.6	98 05.7	41.2	42 59.9	23.0	206 03.0	26.6
20	57 52.9	167 06.7	59.0	113 06.1	40.8	58 02.0	22.8	221 05.5	26.6
21	72 55.3	182 06.4	59.4	128 06.5	40.4	73 04.1	22.6	236 07.9	26.6
22	87 57.8	197 06.0	18 59.9	143 07.0	39.9	88 06.1	22.4	251 10.3	26.6
23	103 00.3	212 05.7	S19 00.3	158 07.4	39.5	103 08.2	22.2	266 12.8	26.6
	h m								
Mer. Pass.	16 13.0	*v* −0.3	*d* 0.5	*v* 0.4	*d* 0.4	*v* 2.1	*d* 0.2	*v* 2.4	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.8
Achernar	335 27.9	S57 11.1
Acrux	173 11.1	S63 09.5
Adhara	255 13.5	S28 59.4
Aldebaran	290 51.1	N16 31.9
Alioth	166 22.0	N55 53.6
Alkaid	153 00.2	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.5	S 8 42.6
Alphecca	126 12.6	N26 40.4
Alpheratz	357 45.5	N29 09.3
Altair	62 10.3	N 8 53.9
Ankaa	353 17.5	S42 14.9
Antares	112 28.6	S26 27.3
Arcturus	145 57.3	N19 07.2
Atria	107 32.5	S69 02.6
Avior	234 18.1	S59 32.8
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.8	N 7 24.5
Canopus	263 56.4	S52 42.3
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.3
Denebola	182 35.2	N14 30.4
Diphda	348 57.7	S17 55.6
Dubhe	193 53.2	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.4	N51 29.1
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.9
Gacrux	172 02.7	S57 10.4
Gienah	175 54.0	S17 36.3
Hadar	148 50.5	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.5	S34 22.7
Kochab	137 20.1	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.7	N 4 08.0
Menkent	148 09.7	S36 25.4
Miaplacidus	221 39.3	S69 45.8
Mirfak	308 42.6	N49 54.2
Nunki	76 00.8	S26 16.9
Peacock	53 22.5	S56 41.9
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.3	N12 33.1
Regulus	207 45.0	N11 54.6
Rigel	281 13.4	S 8 11.4
Rigil Kent.	139 54.3	S60 52.6
Sabik	102 14.8	S15 44.3
Schedar	349 42.7	N56 36.2
Shaula	96 24.6	S37 06.6
Sirius	258 34.9	S16 44.0
Spica	158 33.0	S11 13.2
Suhail	222 53.3	S43 28.7
Vega	80 40.5	N38 47.6
Zuben'ubi	137 07.4	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	111 16.3	8 51
Mars	56 43.1	12 28
Jupiter	0 26.3	16 12
Saturn	163 14.3	5 22

UT	SUN			MOON					
	GHA		Dec	GHA	v	Dec	d	HP	
d h	° ′		° ′	° ′	′	° ′	′	′	
16 00	177 37.6		S21 02.4	51 43.1	8.0	N23 36.2	3.1	56.9	
01	192 37.4		02.0	66 10.1	7.8	23 39.3	3.0	56.9	
02	207 37.2		01.5	80 36.9	7.9	23 42.3	2.8	56.9	
03	222 37.0	. .	01.0	95 03.8	7.7	23 45.1	2.7	57.0	
04	237 36.8		00.6	109 30.5	7.7	23 47.8	2.6	57.0	
05	252 36.5		21 00.1	123 57.2	7.6	23 50.4	2.5	57.1	
06	267 36.3		S20 59.6	138 23.8	7.5	N23 52.9	2.3	57.1	
07	282 36.1		59.2	152 50.3	7.5	23 55.2	2.2	57.1	
08	297 35.9		58.7	167 16.8	7.4	23 57.4	2.1	57.2	
S 09	312 35.7	. .	58.2	181 43.2	7.3	23 59.5	1.9	57.2	
U 10	327 35.5		57.7	196 09.5	7.3	24 01.4	1.7	57.2	
N 11	342 35.3		57.3	210 35.8	7.1	24 03.1	1.7	57.3	
D 12	357 35.0		S20 56.8	225 01.9	7.2	N24 04.8	1.5	57.3	
A 13	12 34.8		56.3	239 28.1	7.0	24 06.3	1.3	57.3	
Y 14	27 34.6		55.8	253 54.1	7.1	24 07.6	1.2	57.4	
15	42 34.4	. .	55.4	268 20.2	6.9	24 08.8	1.1	57.4	
16	57 34.2		54.9	282 46.1	6.9	24 09.9	0.9	57.4	
17	72 34.0		54.4	297 12.0	6.8	24 10.8	0.8	57.5	
18	87 33.8		S20 53.9	311 37.8	6.8	N24 11.6	0.6	57.5	
19	102 33.6		53.4	326 03.6	6.7	24 12.2	0.5	57.6	
20	117 33.3		53.0	340 29.3	6.7	24 12.7	0.3	57.6	
21	132 33.1	. .	52.5	354 55.0	6.6	24 13.0	0.2	57.6	
22	147 32.9		52.0	9 20.6	6.6	24 13.2	0.1	57.7	
23	162 32.7		51.5	23 46.2	6.5	24 13.3	0.1	57.7	
17 00	177 32.5		S20 51.0	38 11.7	6.5	N24 13.2	0.3	57.7	
01	192 32.3		50.5	52 37.2	6.4	24 12.9	0.4	57.8	
02	207 32.1		50.1	67 02.6	6.4	24 12.5	0.6	57.8	
03	222 31.9	. .	49.6	81 28.0	6.3	24 11.9	0.7	57.8	
04	237 31.7		49.1	95 53.3	6.3	24 11.2	0.8	57.9	
05	252 31.5		48.6	110 18.6	6.3	24 10.4	1.0	57.9	
06	267 31.2		S20 48.1	124 43.9	6.2	N24 09.4	1.2	58.0	
07	282 31.0		47.6	139 09.1	6.2	24 08.2	1.3	58.0	
08	297 30.8		47.1	153 34.3	6.1	24 06.9	1.4	58.0	
M 09	312 30.6	. .	46.7	167 59.4	6.1	24 05.5	1.7	58.1	
O 10	327 30.4		46.2	182 24.5	6.1	24 03.8	1.7	58.1	
N 11	342 30.2		45.7	196 49.6	6.0	24 02.1	1.9	58.1	
D 12	357 30.0		S20 45.2	211 14.6	6.0	N24 00.2	2.1	58.2	
A 13	12 29.8		44.7	225 39.6	6.0	23 58.1	2.2	58.2	
Y 14	27 29.6		44.2	240 04.6	6.0	23 55.9	2.4	58.2	
15	42 29.4	. .	43.7	254 29.6	5.9	23 53.5	2.6	58.3	
16	57 29.2		43.2	268 54.5	6.0	23 50.9	2.7	58.3	
17	72 29.0		42.7	283 19.5	5.9	23 48.2	2.8	58.3	
18	87 28.8		S20 42.2	297 44.4	5.8	N23 45.4	3.0	58.4	
19	102 28.6		41.7	312 09.2	5.9	23 42.4	3.2	58.4	
20	117 28.4		41.2	326 34.1	5.8	23 39.2	3.3	58.4	
21	132 28.2	. .	40.7	340 58.9	5.9	23 35.9	3.4	58.5	
22	147 28.0		40.2	355 23.8	5.8	23 32.5	3.7	58.5	
23	162 27.8		39.7	9 48.6	5.8	23 28.8	3.8	58.6	
18 00	177 27.6		S20 39.2	24 13.4	5.8	N23 25.0	3.9	58.6	
01	192 27.4		38.7	38 38.2	5.8	23 21.1	4.1	58.6	
02	207 27.2		38.2	53 03.0	5.7	23 17.0	4.2	58.7	
03	222 27.0	. .	37.7	67 27.7	5.8	23 12.8	4.4	58.7	
04	237 26.8		37.2	81 52.5	5.8	23 08.4	4.6	58.7	
05	252 26.6		36.7	96 17.3	5.8	23 03.8	4.7	58.8	
06	267 26.4		S20 36.2	110 42.1	5.7	N22 59.1	4.8	58.8	
07	282 26.2		35.7	125 06.8	5.8	22 54.3	5.0	58.8	
T 08	297 26.0		35.2	139 31.6	5.8	22 49.3	5.2	58.9	
U 09	312 25.8	. .	34.7	153 56.4	5.8	22 44.1	5.3	58.9	
E 10	327 25.6		34.2	168 21.2	5.8	22 38.8	5.5	58.9	
S 11	342 25.4		33.7	182 46.0	5.8	22 33.3	5.6	59.0	
D 12	357 25.2		S20 33.2	197 10.8	5.8	N22 27.7	5.8	59.0	
A 13	12 25.0		32.7	211 35.6	5.8	22 21.9	5.9	59.0	
Y 14	27 24.8		32.2	226 00.4	5.8	22 16.0	6.1	59.0	
15	42 24.6	. .	31.7	240 25.2	5.9	22 09.9	6.2	59.1	
16	57 24.4		31.2	254 50.1	5.8	22 03.7	6.4	59.1	
17	72 24.2		30.6	269 14.9	5.9	21 57.3	6.6	59.1	
18	87 24.0		S20 30.1	283 39.8	5.9	N21 50.7	6.6	59.2	
19	102 23.8		29.6	298 04.7	5.9	21 44.1	6.9	59.2	
20	117 23.6		29.1	312 29.6	5.9	21 37.2	6.9	59.2	
21	132 23.4	. .	28.6	326 54.5	6.0	21 30.3	7.2	59.3	
22	147 23.2		28.1	341 19.5	6.0	21 23.1	7.2	59.3	
23	162 23.0		27.6	355 44.5	6.0	N21 15.9	7.4	59.3	
	SD 16.3		d 0.5	SD	15.6		15.8		16.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 16	Moonrise 17	Moonrise 18	Moonrise 19
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 57	09 45	▬	▭	▭	▭	▭
N 70	07 42	09 13	11 49	▭	▭	▭	12 58
68	07 31	08 49	10 25	▭	▭	▭	13 58
66	07 21	08 31	09 48	09 19	10 10	12 25	14 32
64	07 13	08 16	09 22	10 35	11 33	13 07	14 56
62	07 06	08 04	09 01	11 12	12 10	13 35	15 15
60	06 59	07 53	08 45	11 38	12 37	13 57	15 31
N 58	06 53	07 43	08 31	11 59	12 57	14 15	15 45
56	06 48	07 35	08 19	12 16	13 15	14 29	15 56
54	06 43	07 28	08 09	12 30	13 29	14 42	16 06
52	06 39	07 21	08 00	12 43	13 42	14 53	16 15
50	06 34	07 15	07 51	12 54	13 53	15 03	16 23
45	06 25	07 01	07 34	13 17	14 16	15 24	16 40
N 40	06 16	06 50	07 19	13 36	14 35	15 41	16 53
35	06 09	06 40	07 07	13 52	14 50	15 55	17 05
30	06 01	06 31	06 56	14 05	15 04	16 08	17 15
20	05 47	06 14	06 38	14 29	15 27	16 29	17 33
N 10	05 33	05 59	06 22	14 49	15 47	16 47	17 48
0	05 18	05 44	06 06	15 08	16 05	17 04	18 02
S 10	05 02	05 28	05 51	15 26	16 24	17 21	18 16
20	04 42	05 10	05 34	15 47	16 44	17 39	18 31
30	04 16	04 48	05 15	16 10	17 07	18 00	18 48
35	04 00	04 35	05 04	16 24	17 20	18 12	18 58
40	03 40	04 19	04 51	16 40	17 36	18 26	19 09
45	03 14	04 00	04 35	16 59	17 54	18 42	19 22
S 50	02 38	03 35	04 16	17 23	18 17	19 02	19 38
52	02 18	03 22	04 07	17 34	18 28	19 12	19 46
54	01 52	03 08	03 56	17 47	18 41	19 23	19 54
56	01 13	02 51	03 45	18 02	18 55	19 35	20 04
58	////	02 30	03 31	18 20	19 12	19 49	20 14
S 60	////	02 02	03 15	18 41	19 32	20 05	20 26

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 16	Moonset 17	Moonset 18	Moonset 19
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	14 36	16 24	▭	▭	▭	▭
N 70	12 32	15 08	16 38	▭	▭	▭	10 51
68	13 56	15 31	16 50	▭	▭	▭	09 50
66	14 33	15 50	17 00	08 24	09 32	09 21	09 15
64	14 59	16 05	17 08	07 08	08 09	08 38	08 50
62	15 19	16 17	17 15	06 31	07 32	08 09	08 30
60	15 36	16 28	17 22	06 05	07 05	07 47	08 13
N 58	15 49	16 37	17 27	05 45	06 45	07 29	08 00
56	16 01	16 45	17 33	05 28	06 27	07 14	07 47
54	16 12	16 53	17 37	05 13	06 13	07 00	07 37
52	16 21	17 00	17 42	05 01	06 00	06 49	07 28
50	16 29	17 06	17 46	04 50	05 49	06 39	07 19
45	16 47	17 19	17 55	04 27	05 25	06 17	07 01
N 40	17 01	17 31	18 04	04 08	05 07	06 00	06 46
35	17 13	17 41	18 12	03 53	04 51	05 45	06 34
30	17 24	17 50	18 19	03 40	04 37	05 32	06 23
20	17 42	18 06	18 33	03 17	04 14	05 10	06 04
N 10	17 58	18 21	18 47	02 57	03 54	04 51	05 47
0	18 14	18 36	19 01	02 38	03 35	04 33	05 32
S 10	18 29	18 52	19 18	02 20	03 16	04 15	05 16
20	18 46	19 10	19 38	02 00	02 56	03 56	04 59
30	19 05	19 31	20 03	01 37	02 32	03 33	04 39
35	19 16	19 45	20 20	01 24	02 18	03 20	04 28
40	19 29	20 00	20 40	01 09	02 02	03 05	04 15
45	19 44	20 20	21 05	00 50	01 43	02 47	03 59
S 50	20 03	20 44	21 41	00 27	01 20	02 24	03 40
52	20 12	20 57	22 00	00 17	01 08	02 14	03 31
54	20 23	21 11	22 25	00 04	00 55	02 01	03 20
56	20 34	21 28	23 02	24 40	00 40	01 47	03 09
58	20 47	21 48	////	24 22	00 22	01 31	02 55
S 60	21 03	22 15	////	24 01	00 01	01 11	02 39

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
16	09 29	09 39	12 10	21 21	08 53	12	86
17	09 50	10 00	12 10	22 19	09 50	13	93
18	10 09	10 19	12 10	23 18	10 48	14	97

UT	ARIES	VENUS −4.4		MARS +1.1		JUPITER −2.2		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
19 00	118 02.7	227 05.3	S19 00.7	173 07.8	S20 39.1	118 10.3	S 1 22.1	281 15.2	S 4 26.6
01	133 05.2	242 05.0	01.2	188 08.2	38.6	133 12.3	21.9	296 17.6	26.6
02	148 07.6	257 04.7	01.6	203 08.7	38.2	148 14.4	21.7	311 20.0	26.6
03	163 10.1	272 04.3	02.0	218 09.1	37.7	163 16.5	21.5	326 22.5	26.6
04	178 12.6	287 04.0	02.5	233 09.5	37.3	178 18.5	21.3	341 24.9	26.6
05	193 15.0	302 03.6	02.9	248 09.9	36.9	193 20.6	21.2	356 27.3	26.6
06	208 17.5	317 03.3	S19 03.3	263 10.4	S20 36.4	208 22.7	S 1 21.0	11 29.8	S 4 26.6
W 07	223 20.0	332 02.9	03.8	278 10.8	36.0	223 24.7	20.8	26 32.2	26.6
E 08	238 22.4	347 02.6	04.2	293 11.2	35.5	238 26.8	20.6	41 34.6	26.6
D 09	253 24.9	2 02.2	04.6	308 11.7	35.1	253 28.9	20.4	56 37.1	26.6
N 10	268 27.4	17 01.9	05.1	323 12.1	34.6	268 30.9	20.2	71 39.5	26.6
E 11	283 29.8	32 01.5	05.5	338 12.5	34.2	283 33.0	20.1	86 41.9	26.6
S 12	298 32.3	47 01.2	S19 05.9	353 12.9	S20 33.8	298 35.1	S 1 19.9	101 44.3	S 4 26.6
D 13	313 34.8	62 00.9	06.3	8 13.4	33.3	313 37.1	19.7	116 46.8	26.6
A 14	328 37.2	77 00.5	06.8	23 13.8	32.9	328 39.2	19.5	131 49.2	26.6
Y 15	343 39.7	92 00.2	07.2	38 14.2	32.4	343 41.3	19.3	146 51.6	26.6
16	358 42.1	106 59.8	07.6	53 14.6	32.0	358 43.3	19.2	161 54.1	26.6
17	13 44.6	121 59.4	08.0	68 15.1	31.5	13 45.4	19.0	176 56.5	26.6
18	28 47.1	136 59.1	S19 08.5	83 15.5	S20 31.1	28 47.5	S 1 18.8	191 58.9	S 4 26.6
19	43 49.5	151 58.7	08.9	98 15.9	30.6	43 49.5	18.6	207 01.4	26.6
20	58 52.0	166 58.4	09.3	113 16.4	30.2	58 51.6	18.4	222 03.8	26.6
21	73 54.5	181 58.0	09.7	128 16.8	29.7	73 53.7	18.3	237 06.2	26.6
22	88 56.9	196 57.7	10.2	143 17.2	29.3	88 55.7	18.1	252 08.7	26.6
23	103 59.4	211 57.3	10.6	158 17.6	28.8	103 57.8	17.9	267 11.1	26.6
20 00	119 01.9	226 57.0	S19 11.0	173 18.1	S20 28.4	118 59.9	S 1 17.7	282 13.5	S 4 26.6
01	134 04.3	241 56.6	11.4	188 18.5	27.9	134 01.9	17.5	297 16.0	26.6
02	149 06.8	256 56.2	11.8	203 18.9	27.5	149 04.0	17.3	312 18.4	26.6
03	164 09.2	271 55.9	12.3	218 19.4	27.0	164 06.0	17.2	327 20.8	26.6
04	179 11.7	286 55.5	12.7	233 19.8	26.6	179 08.1	17.0	342 23.3	26.6
05	194 14.2	301 55.2	13.1	248 20.2	26.1	194 10.2	16.8	357 25.7	26.6
06	209 16.6	316 54.8	S19 13.5	263 20.7	S20 25.7	209 12.2	S 1 16.6	12 28.1	S 4 26.6
T 07	224 19.1	331 54.4	13.9	278 21.1	25.2	224 14.3	16.4	27 30.6	26.6
H 08	239 21.6	346 54.1	14.3	293 21.5	24.8	239 16.4	16.3	42 33.0	26.6
U 09	254 24.0	1 53.7	14.8	308 22.0	24.3	254 18.4	16.1	57 35.5	26.6
R 10	269 26.5	16 53.3	15.2	323 22.4	23.9	269 20.5	15.9	72 37.9	26.6
S 11	284 29.0	31 53.0	15.6	338 22.8	23.4	284 22.5	15.7	87 40.3	26.6
D 12	299 31.4	46 52.6	S19 16.0	353 23.2	S20 23.0	299 24.6	S 1 15.5	102 42.8	S 4 26.6
A 13	314 33.9	61 52.2	16.4	8 23.7	22.5	314 26.7	15.3	117 45.2	26.6
Y 14	329 36.4	76 51.9	16.8	23 24.1	22.1	329 28.7	15.2	132 47.6	26.6
15	344 38.8	91 51.5	17.2	38 24.5	21.6	344 30.8	15.0	147 50.1	26.6
16	359 41.3	106 51.1	17.7	53 25.0	21.2	359 32.8	14.8	162 52.5	26.6
17	14 43.7	121 50.8	18.1	68 25.4	20.7	14 34.9	14.6	177 54.9	26.6
18	29 46.2	136 50.4	S19 18.5	83 25.8	S20 20.2	29 37.0	S 1 14.4	192 57.4	S 4 26.6
19	44 48.7	151 50.0	18.9	98 26.3	19.8	44 39.0	14.2	207 59.8	26.6
20	59 51.1	166 49.7	19.3	113 26.7	19.3	59 41.1	14.1	223 02.2	26.6
21	74 53.6	181 49.3	19.7	128 27.1	18.9	74 43.1	13.9	238 04.7	26.6
22	89 56.1	196 48.9	20.1	143 27.6	18.4	89 45.2	13.7	253 07.1	26.6
23	104 58.5	211 48.5	20.5	158 28.0	18.0	104 47.3	13.5	268 09.6	26.6
21 00	120 01.0	226 48.2	S19 20.9	173 28.4	S20 17.5	119 49.3	S 1 13.3	283 12.0	S 4 26.6
01	135 03.5	241 47.8	21.3	188 28.9	17.0	134 51.4	13.1	298 14.4	26.6
02	150 05.9	256 47.4	21.7	203 29.3	16.6	149 53.4	13.0	313 16.9	26.6
03	165 08.4	271 47.0	22.1	218 29.7	16.1	164 55.5	12.8	328 19.3	26.6
04	180 10.9	286 46.7	22.5	233 30.2	15.7	179 57.6	12.6	343 21.7	26.6
05	195 13.3	301 46.3	22.9	248 30.6	15.2	194 59.6	12.4	358 24.2	26.6
06	210 15.8	316 45.9	S19 23.3	263 31.0	S20 14.7	210 01.7	S 1 12.2	13 26.6	S 4 26.6
07	225 18.2	331 45.5	23.7	278 31.5	14.3	225 03.7	12.0	28 29.1	26.6
08	240 20.7	346 45.1	24.1	293 31.9	13.8	240 05.8	11.9	43 31.5	26.6
F 09	255 23.2	1 44.8	24.5	308 32.3	13.4	255 07.9	11.7	58 33.9	26.6
R 10	270 25.6	16 44.4	24.9	323 32.8	12.9	270 09.9	11.5	73 36.4	26.6
I 11	285 28.1	31 44.0	25.3	338 33.2	12.4	285 12.0	11.3	88 38.8	26.6
D 12	300 30.6	46 43.6	S19 25.7	353 33.6	S20 12.0	300 14.0	S 1 11.1	103 41.3	S 4 26.6
A 13	315 33.0	61 43.2	26.1	8 34.1	11.5	315 16.1	10.9	118 43.7	26.6
Y 14	330 35.5	76 42.8	26.5	23 34.5	11.0	330 18.1	10.7	133 46.1	26.6
15	345 38.0	91 42.4	26.9	38 35.0	10.6	345 20.2	10.6	148 48.6	26.6
16	0 40.4	106 42.1	27.3	53 35.4	10.1	0 22.3	10.4	163 51.0	26.5
17	15 42.9	121 41.7	27.7	68 35.8	09.7	15 24.3	10.2	178 53.5	26.5
18	30 45.4	136 41.3	S19 28.1	83 36.3	S20 09.2	30 26.4	S 1 10.0	193 55.9	S 4 26.5
19	45 47.8	151 40.9	28.5	98 36.7	08.7	45 28.4	09.8	208 58.3	26.5
20	60 50.3	166 40.5	28.9	113 37.1	08.3	60 30.5	09.6	224 00.8	26.5
21	75 52.7	181 40.1	29.3	128 37.6	07.8	75 32.5	09.5	239 03.2	26.5
22	90 55.2	196 39.7	29.7	143 38.0	07.3	90 34.6	09.3	254 05.7	26.5
23	105 57.7	211 39.3	30.1	158 38.4	06.9	105 36.6	09.1	269 08.1	26.5
	h m								
Mer. Pass.	16 01.2	v −0.4	d 0.4	v 0.4	d 0.5	v 2.1	d 0.2	v 2.4	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.5	S40 15.8
Achernar	335 28.0	S57 11.1
Acrux	173 11.1	S63 09.5
Adhara	255 13.5	S28 59.4
Aldebaran	290 51.1	N16 31.9
Alioth	166 21.9	N55 53.6
Alkaid	153 00.1	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.5	S 8 42.6
Alphecca	126 12.6	N26 40.4
Alpheratz	357 45.5	N29 09.3
Altair	62 10.2	N 8 53.9
Ankaa	353 17.5	S42 14.9
Antares	112 28.6	S26 27.3
Arcturus	145 57.3	N19 07.2
Atria	107 32.4	S69 02.6
Avior	234 18.1	S59 32.8
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.8	N 7 24.5
Canopus	263 56.4	S52 42.3
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.3
Denebola	182 35.2	N14 30.4
Diphda	348 57.7	S17 55.6
Dubhe	193 53.2	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.4	N51 29.1
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.9
Gacrux	172 02.7	S57 10.4
Gienah	175 53.9	S17 36.3
Hadar	148 50.5	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.4	S34 22.7
Kochab	137 20.1	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.7	N 4 08.0
Menkent	148 09.6	S36 25.4
Miaplacidus	221 39.3	S69 45.8
Mirfak	308 42.6	N49 54.3
Nunki	76 00.8	S26 16.9
Peacock	53 22.4	S56 41.9
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.3	N12 33.0
Regulus	207 45.0	N11 54.6
Rigel	281 13.4	S 8 11.4
Rigil Kent.	139 54.3	S60 52.6
Sabik	102 14.8	S15 44.3
Schedar	349 42.8	N56 36.2
Shaula	96 24.6	S37 06.6
Sirius	258 34.9	S16 44.0
Spica	158 33.0	S11 13.2
Suhail	222 53.3	S43 28.7
Vega	80 40.5	N38 47.6
Zuben'ubi	137 07.4	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	107 55.1	8 52
Mars	54 16.2	12 26
Jupiter	359 58.0	16 02
Saturn	163 11.7	5 10

UT	SUN			MOON						Lat.	Twilight		Sunrise	Moonrise			
	GHA		Dec	GHA		v	Dec		d	HP		Naut.	Civil		19	20	21	22
d h	°	′	° ′	°	′	′	°	′	′	′	°	h m	h m	h m	h m	h m	h m	h m
19 00	177	22.8	S20 27.0	10	09.5	6.0	N21	08.5	7.6	59.3	N 72	07 49	09 32	▬	▭	15 21	17 59	20 19
01	192	22.6	26.5	24	34.5	6.0	21	00.9	7.7	59.4	N 70	07 36	09 03	11 08	12 58	15 53	18 12	20 21
02	207	22.4	26.0	38	59.5	6.1	20	53.2	7.8	59.4	68	07 25	08 42	10 11	13 58	16 16	18 23	20 24
03	222	22.2	. . 25.5	53	24.6	6.1	20	45.4	8.0	59.4	66	07 16	08 25	09 38	14 32	16 34	18 32	20 26
04	237	22.0	25.0	67	49.7	6.2	20	37.4	8.1	59.5	64	07 08	08 11	09 14	14 56	16 49	18 39	20 27
05	252	21.8	24.5	82	14.9	6.1	20	29.3	8.3	59.5	62	07 02	07 59	08 55	15 15	17 01	18 46	20 29
06	267	21.6	S20 23.9	96	40.0	6.2	N20	21.0	8.4	59.5	60	06 56	07 49	08 40	15 31	17 11	18 51	20 30
W 07	282	21.4	23.4	111	05.2	6.3	20	12.6	8.5	59.5	N 58	06 50	07 40	08 27	15 45	17 20	18 56	20 31
E 08	297	21.3	22.9	125	30.5	6.3	20	04.1	8.7	59.6	56	06 45	07 32	08 15	15 56	17 28	19 00	20 32
D 09	312	21.1	. . 22.4	139	55.8	6.3	19	55.4	8.8	59.6	54	06 41	07 25	08 05	16 06	17 35	19 04	20 33
N 10	327	20.9	21.9	154	21.1	6.3	19	46.6	9.0	59.6	52	06 36	07 18	07 57	16 15	17 41	19 08	20 34
E 11	342	20.7	21.3	168	46.4	6.4	19	37.6	9.1	59.6	50	06 32	07 12	07 49	16 23	17 46	19 11	20 34
S 12	357	20.5	S20 20.8	183	11.8	6.4	N19	28.5	9.2	59.7	45	06 23	06 59	07 32	16 40	17 58	19 17	20 36
D 13	12	20.3	20.3	197	37.2	6.5	19	19.3	9.4	59.7	N 40	06 15	06 48	07 18	16 53	18 08	19 23	20 37
A 14	27	20.1	19.8	212	02.7	6.5	19	09.9	9.4	59.7	35	06 08	06 39	07 06	17 05	18 16	19 28	20 38
Y 15	42	19.9	. . 19.2	226	28.2	6.5	19	00.5	9.7	59.7	30	06 01	06 30	06 56	17 15	18 24	19 32	20 39
16	57	19.7	18.7	240	53.7	6.6	18	50.8	9.7	59.8	20	05 47	06 14	06 38	17 33	18 37	19 39	20 41
17	72	19.5	18.2	255	19.3	6.6	18	41.1	9.9	59.8	N 10	05 34	06 00	06 22	17 48	18 48	19 46	20 43
18	87	19.3	S20 17.6	269	44.9	6.7	N18	31.2	10.0	59.8	0	05 20	05 45	06 07	18 02	18 58	19 52	20 44
19	102	19.2	17.1	284	10.6	6.7	18	21.2	10.1	59.8	S 10	05 03	05 30	05 52	18 16	19 08	19 58	20 46
20	117	19.0	16.6	298	36.3	6.8	18	11.1	10.2	59.9	20	04 44	05 12	05 36	18 31	19 19	20 04	20 47
21	132	18.8	. . 16.1	313	02.1	6.8	18	00.9	10.4	59.9	30	04 19	04 51	05 18	18 48	19 32	20 11	20 49
22	147	18.6	15.5	327	27.9	6.8	17	50.5	10.5	59.9	35	04 03	04 38	05 07	18 58	19 39	20 16	20 50
23	162	18.4	15.0	341	53.7	6.9	17	40.0	10.6	59.9	40	03 44	04 23	04 54	19 09	19 47	20 20	20 51
20 00	177	18.2	S20 14.5	356	19.6	6.9	N17	29.4	10.7	59.9	45	03 19	04 04	04 39	19 22	19 56	20 26	20 53
01	192	18.0	13.9	10	45.5	7.0	17	18.7	10.8	60.0	S 50	02 44	03 40	04 21	19 38	20 08	20 32	20 54
02	207	17.8	13.4	25	11.5	7.1	17	07.9	11.0	60.0	52	02 26	03 28	04 12	19 46	20 13	20 35	20 55
03	222	17.7	. . 12.9	39	37.6	7.0	16	56.9	11.1	60.0	54	02 02	03 14	04 02	19 54	20 19	20 38	20 56
04	237	17.5	12.3	54	03.6	7.2	16	45.8	11.2	60.0	56	01 29	02 58	03 51	20 04	20 25	20 42	20 57
05	252	17.3	11.8	68	29.8	7.2	16	34.6	11.2	60.0	58	////	02 38	03 38	20 14	20 32	20 46	20 58
06	267	17.1	S20 11.3	82	56.0	7.2	N16	23.4	11.5	60.1	S 60	////	02 13	03 23	20 26	20 40	20 50	20 59
T 07	282	16.9	10.7	97	22.2	7.3	16	11.9	11.5	60.1								
H 08	297	16.7	10.2	111	48.5	7.3	16	00.4	11.6	60.1								
U 09	312	16.5	. . 09.7	126	14.8	7.4	15	48.8	11.7	60.1								
R 10	327	16.4	09.1	140	41.2	7.4	15	37.1	11.8	60.1								
S 11	342	16.2	08.6	155	07.6	7.5	15	25.3	12.0	60.1								
D 12	357	16.0	S20 08.0	169	34.1	7.5	N15	13.3	12.0	60.2								
A 13	12	15.8	07.5	184	00.6	7.6	15	01.3	12.2	60.2								
Y 14	27	15.6	07.0	198	27.2	7.6	14	49.1	12.2	60.2								
15	42	15.5	. . 06.4	212	53.8	7.7	14	36.9	12.3	60.2								
16	57	15.3	05.9	227	20.5	7.7	14	24.6	12.4	60.2								
17	72	15.1	05.3	241	47.2	7.8	14	12.2	12.6	60.2								
18	87	14.9	S20 04.8	256	14.0	7.8	N13	59.6	12.6	60.2								
19	102	14.7	04.2	270	40.8	7.9	13	47.0	12.7	60.3								
20	117	14.5	03.7	285	07.7	7.9	13	34.3	12.7	60.3								
21	132	14.4	. . 03.2	299	34.6	8.0	13	21.6	12.9	60.3								
22	147	14.2	02.6	314	01.6	8.0	13	08.7	13.0	60.3								
23	162	14.0	02.1	328	28.6	8.1	12	55.7	13.0	60.3								
21 00	177	13.8	S20 01.5	342	55.7	8.1	N12	42.7	13.1	60.3								
01	192	13.6	01.0	357	22.8	8.2	12	29.6	13.3	60.3								
02	207	13.5	20 00.4	11	50.0	8.2	12	16.3	13.2	60.3								
03	222	13.3	19 59.9	26	17.2	8.3	12	03.1	13.4	60.3								
04	237	13.1	59.3	40	44.5	8.3	11	49.7	13.4	60.4								
05	252	12.9	58.8	55	11.8	8.4	11	36.3	13.5	60.4								
06	267	12.8	S19 58.2	69	39.2	8.4	N11	22.8	13.6	60.4								
07	282	12.6	57.7	84	06.6	8.5	11	09.2	13.7	60.4								
08	297	12.4	57.1	98	34.1	8.5	10	55.5	13.7	60.4								
F 09	312	12.2	. . 56.6	113	01.6	8.6	10	41.8	13.8	60.4								
R 10	327	12.0	56.0	127	29.2	8.6	10	28.0	13.8	60.4								
I 11	342	11.9	55.4	141	56.8	8.7	10	14.2	13.9	60.4								
D 12	357	11.7	S19 54.9	156	24.5	8.7	N10	00.3	14.0	60.4								
A 13	12	11.5	54.3	170	52.2	8.7	9	46.3	14.1	60.4								
Y 14	27	11.3	53.8	185	19.9	8.8	9	32.2	14.1	60.4								
15	42	11.2	. . 53.2	199	47.7	8.8	9	18.1	14.1	60.4								
16	57	11.0	52.7	214	15.5	8.9	9	04.0	14.2	60.4								
17	72	10.8	52.1	228	43.4	8.9	8	49.8	14.3	60.4								
18	87	10.7	S19 51.5	243	11.3	9.0	N 8	35.5	14.3	60.4								
19	102	10.5	51.0	257	39.3	9.0	8	21.2	14.3	60.4								
20	117	10.3	50.4	272	07.3	9.0	8	06.9	14.5	60.4								
21	132	10.1	. . 49.9	286	35.3	9.1	7	52.4	14.4	60.4								
22	147	10.0	49.3	301	03.4	9.2	7	38.0	14.5	60.4								
23	162	09.8	48.7	315	31.6	9.1	N 7	23.5	14.5	60.4								
	SD	16.3	d 0.5	SD	16.3			16.4		16.5								

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	19	20	21	22
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	14 51	16 34	▭	10 29	09 46	09 18
N 70	13 15	15 20	16 47	10 51	09 55	09 30	09 12
68	14 11	15 41	16 58	09 50	09 30	09 17	09 07
66	14 44	15 58	17 07	09 15	09 11	09 06	09 02
64	15 08	16 12	17 14	08 50	08 55	08 57	08 58
62	15 27	16 24	17 21	08 30	08 42	08 50	08 55
60	15 43	16 34	17 27	08 13	08 31	08 43	08 52
N 58	15 56	16 43	17 32	08 00	08 21	08 37	08 49
56	16 07	16 51	17 37	07 47	08 12	08 31	08 47
54	16 17	16 58	17 42	07 37	08 05	08 27	08 45
52	16 26	17 04	17 46	07 28	07 58	08 22	08 43
50	16 34	17 10	17 50	07 19	07 51	08 18	08 41
45	16 51	17 23	17 59	07 01	07 38	08 09	08 37
N 40	17 04	17 34	18 07	06 46	07 27	08 02	08 34
35	17 16	17 43	18 14	06 34	07 17	07 56	08 31
30	17 26	17 52	18 21	06 23	07 09	07 50	08 29
20	17 44	18 08	18 35	06 04	06 54	07 41	08 24
N 10	18 00	18 22	18 48	05 47	06 41	07 32	08 21
0	18 15	18 37	19 02	05 32	06 29	07 24	08 17
S 10	18 29	18 52	19 18	05 16	06 16	07 16	08 13
20	18 45	19 09	19 38	04 59	06 03	07 07	08 09
30	19 04	19 30	20 02	04 39	05 48	06 56	08 04
35	19 15	19 43	20 18	04 28	05 39	06 51	08 02
40	19 27	19 58	20 37	04 15	05 29	06 44	07 58
45	19 42	20 17	21 02	03 59	05 17	06 36	07 55
S 50	20 00	20 41	21 36	03 40	05 02	06 26	07 51
52	20 09	20 53	21 54	03 31	04 55	06 22	07 48
54	20 19	21 06	22 17	03 20	04 47	06 17	07 46
56	20 30	21 22	22 49	03 09	04 39	06 11	07 44
58	20 42	21 41	////	02 55	04 29	06 05	07 41
S 60	20 57	22 06	////	02 39	04 18	05 58	07 38

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
19	10 28	10 38	12 11	24 15	11 47	15	100
20	10 47	10 56	12 11	00 15	12 43	16	99
21	11 04	11 13	12 11	01 11	13 38	17	96

UT	ARIES	VENUS −4.4		MARS +1.1		JUPITER −2.2		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
22 00	121 00.1	226 38.9	S19 30.5	173 38.9	S20 06.4	120 38.7	S 1 08.9	284 10.6	S 4 26.5
01	136 02.6	241 38.6	30.9	188 39.3	05.9	135 40.8	08.7	299 13.0	26.5
02	151 05.1	256 38.2	31.3	203 39.8	05.5	150 42.8	08.5	314 15.4	26.5
03	166 07.5	271 37.8	31.6	218 40.2	05.0	165 44.9	08.3	329 17.9	26.5
04	181 10.0	286 37.4	32.0	233 40.6	04.5	180 46.9	08.2	344 20.3	26.5
05	196 12.5	301 37.0	32.4	248 41.1	04.0	195 49.0	08.0	359 22.8	26.5
06	211 14.9	316 36.6	S19 32.8	263 41.5	S20 03.6	210 51.0	S 1 07.8	14 25.2	S 4 26.5
07	226 17.4	331 36.2	33.2	278 41.9	03.1	225 53.1	07.6	29 27.7	26.5
S 08	241 19.8	346 35.8	33.6	293 42.4	02.6	240 55.1	07.4	44 30.1	26.5
A 09	256 22.3	1 35.4	34.0	308 42.8	02.2	255 57.2	07.2	59 32.5	26.5
T 10	271 24.8	16 35.0	34.4	323 43.3	01.7	270 59.2	07.0	74 35.0	26.5
U 11	286 27.2	31 34.6	34.7	338 43.7	01.2	286 01.3	06.9	89 37.4	26.5
R 12	301 29.7	46 34.2	S19 35.1	353 44.1	S20 00.7	301 03.4	S 1 06.7	104 39.9	S 4 26.5
D 13	316 32.2	61 33.8	35.5	8 44.6	20 00.3	316 05.4	06.5	119 42.3	26.5
A 14	331 34.6	76 33.4	35.9	23 45.0	19 59.8	331 07.5	06.3	134 44.8	26.5
Y 15	346 37.1	91 33.0	36.3	38 45.5	59.3	346 09.5	06.1	149 47.2	26.5
16	1 39.6	106 32.6	36.6	53 45.9	58.9	1 11.6	05.9	164 49.6	26.5
17	16 42.0	121 32.2	37.0	68 46.3	58.4	16 13.6	05.7	179 52.1	26.4
18	31 44.5	136 31.8	S19 37.4	83 46.8	S19 57.9	31 15.7	S 1 05.5	194 54.5	S 4 26.4
19	46 47.0	151 31.4	37.8	98 47.2	57.4	46 17.7	05.4	209 57.0	26.4
20	61 49.4	166 31.0	38.2	113 47.7	57.0	61 19.8	05.2	224 59.4	26.4
21	76 51.9	181 30.6	38.5	128 48.1	56.5	76 21.8	05.0	240 01.9	26.4
22	91 54.3	196 30.1	38.9	143 48.5	56.0	91 23.9	04.8	255 04.3	26.4
23	106 56.8	211 29.7	39.3	158 49.0	55.5	106 25.9	04.6	270 06.8	26.4
23 00	121 59.3	226 29.3	S19 39.7	173 49.4	S19 55.1	121 28.0	S 1 04.4	285 09.2	S 4 26.4
01	137 01.7	241 28.9	40.0	188 49.9	54.6	136 30.0	04.2	300 11.7	26.4
02	152 04.2	256 28.5	40.4	203 50.3	54.1	151 32.1	04.1	315 14.1	26.4
03	167 06.7	271 28.1	40.8	218 50.7	53.6	166 34.1	03.9	330 16.5	26.4
04	182 09.1	286 27.7	41.2	233 51.2	53.1	181 36.2	03.7	345 19.0	26.4
05	197 11.6	301 27.3	41.5	248 51.6	52.7	196 38.2	03.5	0 21.4	26.4
06	212 14.1	316 26.9	S19 41.9	263 52.1	S19 52.2	211 40.3	S 1 03.3	15 23.9	S 4 26.4
07	227 16.5	331 26.4	42.3	278 52.5	51.7	226 42.3	03.1	30 26.3	26.4
08	242 19.0	346 26.0	42.6	293 53.0	51.2	241 44.4	02.9	45 28.8	26.4
S 09	257 21.4	1 25.6	43.0	308 53.4	50.7	256 46.4	02.7	60 31.2	26.4
U 10	272 23.9	16 25.2	43.4	323 53.8	50.3	271 48.5	02.6	75 33.7	26.4
N 11	287 26.4	31 24.8	43.7	338 54.3	49.8	286 50.5	02.4	90 36.1	26.3
D 12	302 28.8	46 24.4	S19 44.1	353 54.7	S19 49.3	301 52.6	S 1 02.2	105 38.6	S 4 26.3
A 13	317 31.3	61 24.0	44.5	8 55.2	48.8	316 54.6	02.0	120 41.0	26.3
Y 14	332 33.8	76 23.5	44.8	23 55.6	48.3	331 56.7	01.8	135 43.5	26.3
15	347 36.2	91 23.1	45.2	38 56.1	47.9	346 58.7	01.6	150 45.9	26.3
16	2 38.7	106 22.7	45.6	53 56.5	47.4	2 00.8	01.4	165 48.4	26.3
17	17 41.2	121 22.3	45.9	68 56.9	46.9	17 02.8	01.2	180 50.8	26.3
18	32 43.6	136 21.9	S19 46.3	83 57.4	S19 46.4	32 04.9	S 1 01.0	195 53.3	S 4 26.3
19	47 46.1	151 21.4	46.7	98 57.8	45.9	47 06.9	00.9	210 55.7	26.3
20	62 48.6	166 21.0	47.0	113 58.3	45.4	62 09.0	00.7	225 58.2	26.3
21	77 51.0	181 20.6	47.4	128 58.7	45.0	77 11.0	00.5	241 00.6	26.3
22	92 53.5	196 20.2	47.8	143 59.2	44.5	92 13.1	00.3	256 03.1	26.3
23	107 55.9	211 19.7	48.1	158 59.6	44.0	107 15.1	1 00.1	271 05.5	26.3
24 00	122 58.4	226 19.3	S19 48.5	174 00.0	S19 43.5	122 17.2	S 0 59.9	286 08.0	S 4 26.3
01	138 00.9	241 18.9	48.8	189 00.5	43.0	137 19.2	59.7	301 10.4	26.3
02	153 03.3	256 18.5	49.2	204 00.9	42.5	152 21.2	59.5	316 12.9	26.2
03	168 05.8	271 18.0	49.5	219 01.4	42.0	167 23.3	59.3	331 15.3	26.2
04	183 08.3	286 17.6	49.9	234 01.8	41.5	182 25.3	59.2	346 17.8	26.2
05	198 10.7	301 17.2	50.3	249 02.3	41.1	197 27.4	59.0	1 20.2	26.2
06	213 13.2	316 16.8	S19 50.6	264 02.7	S19 40.6	212 29.4	S 0 58.8	16 22.7	S 4 26.2
07	228 15.7	331 16.3	51.0	279 03.2	40.1	227 31.5	58.6	31 25.1	26.2
08	243 18.1	346 15.9	51.3	294 03.6	39.6	242 33.5	58.4	46 27.6	26.2
M 09	258 20.6	1 15.5	51.7	309 04.1	39.1	257 35.6	58.2	61 30.0	26.2
O 10	273 23.1	16 15.0	52.0	324 04.5	38.6	272 37.6	58.0	76 32.5	26.2
N 11	288 25.5	31 14.6	52.4	339 05.0	38.1	287 39.7	57.8	91 34.9	26.2
D 12	303 28.0	46 14.2	S19 52.7	354 05.4	S19 37.6	302 41.7	S 0 57.6	106 37.4	S 4 26.2
A 13	318 30.4	61 13.7	53.1	9 05.8	37.1	317 43.7	57.5	121 39.8	26.2
Y 14	333 32.9	76 13.3	53.4	24 06.3	36.7	332 45.8	57.3	136 42.3	26.2
15	348 35.4	91 12.9	53.8	39 06.7	36.2	347 47.8	57.1	151 44.7	26.1
16	3 37.8	106 12.4	54.1	54 07.2	35.7	2 49.9	56.9	166 47.2	26.1
17	18 40.3	121 12.0	54.5	69 07.6	35.2	17 51.9	56.7	181 49.6	26.1
18	33 42.8	136 11.6	S19 54.8	84 08.1	S19 34.7	32 54.0	S 0 56.5	196 52.1	S 4 26.1
19	48 45.2	151 11.1	55.2	99 08.5	34.2	47 56.0	56.3	211 54.5	26.1
20	63 47.7	166 10.7	55.5	114 09.0	33.7	62 58.1	56.1	226 57.0	26.1
21	78 50.2	181 10.2	55.8	129 09.4	33.2	78 00.1	55.9	241 59.5	26.1
22	93 52.6	196 09.8	56.2	144 09.9	32.7	93 02.1	55.7	257 01.9	26.1
23	108 55.1	211 09.4	56.5	159 10.3	32.2	108 04.2	55.6	272 04.4	26.1
	h m								
Mer. Pass.	15 49.4	v −0.4	d 0.4	v 0.4	d 0.5	v 2.0	d 0.2	v 2.4	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.5	S40 15.8
Achernar	335 28.0	S57 11.1
Acrux	173 11.0	S63 09.5
Adhara	255 13.5	S28 59.4
Aldebaran	290 51.1	N16 31.9
Alioth	166 21.9	N55 53.6
Alkaid	153 00.1	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.6	N26 40.4
Alpheratz	357 45.5	N29 09.3
Altair	62 10.2	N 8 53.9
Ankaa	353 17.5	S42 14.9
Antares	112 28.6	S26 27.3
Arcturus	145 57.3	N19 07.2
Atria	107 32.4	S69 02.6
Avior	234 18.1	S59 32.8
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.8	N 7 24.5
Canopus	263 56.4	S52 42.3
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.3
Denebola	182 35.2	N14 30.3
Diphda	348 57.7	S17 55.6
Dubhe	193 53.1	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.4	N51 29.1
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.9
Gacrux	172 02.7	S57 10.4
Gienah	175 53.9	S17 36.3
Hadar	148 50.4	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.4	S34 22.7
Kochab	137 20.0	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.7	N 4 08.0
Menkent	148 09.6	S36 25.4
Miaplacidus	221 39.3	S69 45.8
Mirfak	308 42.7	N49 54.3
Nunki	76 00.8	S26 16.9
Peacock	53 22.4	S56 41.9
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.3	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.4	S 8 11.5
Rigil Kent.	139 54.2	S60 52.6
Sabik	102 14.7	S15 44.3
Schedar	349 42.8	N56 36.2
Shaula	96 24.6	S37 06.6
Sirius	258 34.9	S16 44.0
Spica	158 33.0	S11 13.2
Suhail	222 53.3	S43 28.7
Vega	80 40.5	N38 47.6
Zuben'ubi	137 07.4	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	104 30.1	8 54
Mars	51 50.1	12 24
Jupiter	359 28.7	15 52
Saturn	163 09.9	4 59

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
22 00	177 09.6	S19 48.2	329 59.7	9.2	N 7 09.0	14.6	60.4
01	192 09.4	47.6	344 27.9	9.3	6 54.4	14.7	60.4
02	207 09.3	47.1	358 56.2	9.2	6 39.7	14.6	60.4
03	222 09.1	. . 46.5	13 24.4	9.4	6 25.1	14.7	60.4
04	237 08.9	45.9	27 52.8	9.3	6 10.4	14.7	60.4
05	252 08.8	45.4	42 21.1	9.4	5 55.7	14.8	60.4
06	267 08.6	S19 44.8	56 49.5	9.4	N 5 40.9	14.8	60.4
07	282 08.4	44.2	71 17.9	9.5	5 26.1	14.8	60.4
S 08	297 08.3	43.7	85 46.4	9.5	5 11.3	14.9	60.4
A 09	312 08.1	. . 43.1	100 14.9	9.5	4 56.4	14.8	60.4
T 10	327 07.9	42.5	114 43.4	9.5	4 41.6	14.9	60.4
U 11	342 07.8	41.9	129 11.9	9.6	4 26.7	15.0	60.4
R 12	357 07.6	S19 41.4	143 40.5	9.6	N 4 11.7	14.9	60.4
D 13	12 07.4	40.8	158 09.1	9.6	3 56.8	15.0	60.4
A 14	27 07.2	40.2	172 37.7	9.7	3 41.8	15.0	60.4
Y 15	42 07.1	. . 39.7	187 06.4	9.7	3 26.8	15.0	60.4
16	57 06.9	39.1	201 35.1	9.7	3 11.8	15.0	60.4
17	72 06.8	38.5	216 03.8	9.8	2 56.8	15.0	60.4
18	87 06.6	S19 37.9	230 32.6	9.7	N 2 41.8	15.0	60.4
19	102 06.4	37.4	245 01.3	9.8	2 26.8	15.1	60.4
20	117 06.3	36.8	259 30.1	9.8	2 11.7	15.0	60.4
21	132 06.1	. . 36.2	273 58.9	9.9	1 56.7	15.1	60.4
22	147 05.9	35.6	288 27.8	9.8	1 41.6	15.0	60.3
23	162 05.8	35.1	302 56.6	9.9	1 26.6	15.1	60.3
23 00	177 05.6	S19 34.5	317 25.5	9.9	N 1 11.5	15.0	60.3
01	192 05.4	33.9	331 54.4	9.9	0 56.5	15.1	60.3
02	207 05.3	33.3	346 23.3	9.9	0 41.4	15.1	60.3
03	222 05.1	. . 32.7	0 52.2	10.0	0 26.3	15.0	60.3
04	237 04.9	32.2	15 21.2	9.9	N 0 11.3	15.1	60.3
05	252 04.8	31.6	29 50.1	10.0	S 0 03.8	15.0	60.3
06	267 04.6	S19 31.0	44 19.1	10.0	S 0 18.8	15.0	60.3
07	282 04.5	30.4	58 48.1	10.0	0 33.8	15.1	60.3
S 08	297 04.3	29.8	73 17.1	10.0	0 48.9	15.0	60.2
U 09	312 04.1	. . 29.2	87 46.1	10.1	1 03.9	15.0	60.2
N 10	327 04.0	28.7	102 15.2	10.0	1 18.9	15.0	60.2
D 11	342 03.8	28.1	116 44.2	10.0	1 33.9	14.9	60.2
A 12	357 03.7	S19 27.5	131 13.2	10.1	S 1 48.8	15.0	60.2
Y 13	12 03.5	26.9	145 42.3	10.0	2 03.8	14.9	60.2
14	27 03.3	26.3	160 11.3	10.1	2 18.7	14.9	60.2
15	42 03.2	. . 25.7	174 40.4	10.1	2 33.6	14.9	60.1
16	57 03.0	25.1	189 09.5	10.1	2 48.5	14.8	60.1
17	72 02.9	24.6	203 38.6	10.0	3 03.3	14.9	60.1
18	87 02.7	S19 24.0	218 07.6	10.1	S 3 18.2	14.8	60.1
19	102 02.5	23.4	232 36.7	10.1	3 33.0	14.8	60.1
20	117 02.4	22.8	247 05.8	10.1	3 47.8	14.7	60.1
21	132 02.2	. . 22.2	261 34.9	10.1	4 02.5	14.7	60.1
22	147 02.1	21.6	276 04.0	10.1	4 17.2	14.7	60.0
23	162 01.9	21.0	290 33.1	10.0	4 31.9	14.7	60.0
24 00	177 01.8	S19 20.4	305 02.1	10.1	S 4 46.6	14.6	60.0
01	192 01.6	19.8	319 31.2	10.1	5 01.2	14.5	60.0
02	207 01.5	19.2	334 00.3	10.1	5 15.7	14.6	60.0
03	222 01.3	. . 18.6	348 29.4	10.0	5 30.3	14.5	60.0
04	237 01.1	18.0	2 58.4	10.1	5 44.8	14.4	59.9
05	252 01.0	17.4	17 27.5	10.0	5 59.2	14.4	59.9
06	267 00.8	S19 16.8	31 56.5	10.1	S 6 13.6	14.4	59.9
07	282 00.7	16.2	46 25.6	10.0	6 28.0	14.3	59.9
08	297 00.5	15.6	60 54.6	10.1	6 42.3	14.3	59.9
M 09	312 00.4	. . 15.0	75 23.7	10.0	6 56.6	14.2	59.8
O 10	327 00.2	14.5	89 52.7	10.0	7 10.8	14.1	59.8
N 11	342 00.1	13.9	104 21.7	10.0	7 24.9	14.2	59.8
D 12	356 59.9	S19 13.2	118 50.7	10.0	S 7 39.1	14.0	59.8
A 13	11 59.8	12.6	133 19.7	9.9	7 53.1	14.0	59.8
Y 14	26 59.6	12.0	147 48.6	10.0	8 07.1	14.0	59.7
15	41 59.5	. . 11.4	162 17.6	9.9	8 21.1	13.9	59.7
16	56 59.3	10.8	176 46.5	9.9	8 35.0	13.8	59.7
17	71 59.2	10.2	191 15.4	9.9	8 48.8	13.8	59.7
18	86 59.0	S19 09.6	205 44.3	9.9	S 9 02.6	13.7	59.7
19	101 58.9	09.0	220 13.2	9.9	9 16.3	13.7	59.6
20	116 58.7	08.4	234 42.1	9.9	9 30.0	13.5	59.6
21	131 58.6	. . 07.8	249 11.0	9.8	9 43.5	13.6	59.6
22	146 58.4	07.2	263 39.8	9.8	9 57.1	13.4	59.6
23	161 58.3	06.6	278 08.6	9.8	S10 10.5	13.4	59.6
	SD 16.3	d 0.6	SD	16.5		16.4	16.3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 22	Moonrise 23	Moonrise 24	Moonrise 25
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 40	09 19	▬	20 19	22 34	24 55	00 55
N 70	07 28	08 53	10 43	20 21	22 27	24 36	00 36
68	07 19	08 34	09 58	20 24	22 22	24 21	00 21
66	07 10	08 18	09 28	20 26	22 17	24 09	00 09
64	07 03	08 05	09 06	20 27	22 14	23 59	25 46
62	06 57	07 54	08 49	20 29	22 10	23 51	25 32
60	06 51	07 44	08 34	20 30	22 07	23 44	25 20
N 58	06 46	07 35	08 22	20 31	22 05	23 38	25 10
56	06 42	07 28	08 11	20 32	22 03	23 32	25 01
54	06 38	07 21	08 02	20 33	22 01	23 27	24 53
52	06 34	07 15	07 53	20 34	21 59	23 23	24 46
50	06 30	07 10	07 46	20 34	21 57	23 19	24 39
45	06 21	06 57	07 29	20 36	21 54	23 10	24 26
N 40	06 14	06 47	07 16	20 37	21 51	23 03	24 15
35	06 07	06 38	07 05	20 38	21 48	22 57	24 05
30	06 00	06 29	06 55	20 39	21 46	22 52	23 57
20	05 47	06 14	06 38	20 41	21 42	22 42	23 43
N 10	05 35	06 00	06 22	20 43	21 39	22 34	23 31
0	05 21	05 46	06 08	20 44	21 36	22 27	23 19
S 10	05 05	05 31	05 54	20 46	21 33	22 20	23 08
20	04 46	05 14	05 38	20 47	21 29	22 12	22 56
30	04 22	04 54	05 20	20 49	21 26	22 03	22 42
35	04 07	04 41	05 10	20 50	21 24	21 58	22 34
40	03 48	04 27	04 58	20 51	21 21	21 52	22 25
45	03 24	04 09	04 43	20 53	21 19	21 46	22 15
S 50	02 52	03 45	04 26	20 54	21 16	21 38	22 02
52	02 34	03 34	04 17	20 55	21 14	21 34	21 57
54	02 12	03 21	04 08	20 56	21 13	21 30	21 50
56	01 43	03 06	03 57	20 57	21 11	21 26	21 43
58	00 51	02 48	03 45	20 58	21 09	21 21	21 35
S 60	////	02 24	03 31	20 59	21 07	21 16	21 26

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 22	Moonset 23	Moonset 24	Moonset 25
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	15 05	16 45	09 18	08 54	08 29	07 58
N 70	13 41	15 31	16 56	09 12	08 55	08 38	08 19
68	14 27	15 51	17 06	09 07	08 57	08 47	08 35
66	14 56	16 07	17 14	09 02	08 58	08 53	08 49
64	15 18	16 20	17 21	08 58	08 59	08 59	09 00
62	15 35	16 31	17 27	08 55	09 00	09 04	09 10
60	15 50	16 40	17 33	08 52	09 00	09 08	09 18
N 58	16 02	16 49	17 38	08 49	09 01	09 12	09 25
56	16 13	16 56	17 42	08 47	09 01	09 16	09 32
54	16 23	17 03	17 47	08 45	09 02	09 19	09 38
52	16 31	17 09	17 51	08 43	09 02	09 22	09 43
50	16 38	17 15	17 54	08 41	09 03	09 24	09 48
45	16 55	17 27	18 03	08 37	09 04	09 30	09 58
N 40	17 08	17 37	18 10	08 34	09 05	09 35	10 07
35	17 19	17 46	18 17	08 31	09 05	09 39	10 14
30	17 29	17 55	18 24	08 29	09 06	09 43	10 21
20	17 46	18 09	18 36	08 24	09 07	09 49	10 32
N 10	18 01	18 23	18 49	08 21	09 08	09 55	10 42
0	18 15	18 37	19 03	08 17	09 09	10 00	10 52
S 10	18 30	18 52	19 18	08 13	09 09	10 05	11 01
20	18 45	19 09	19 37	08 09	09 10	10 11	11 11
30	19 03	19 29	20 01	08 04	09 11	10 17	11 23
35	19 13	19 42	20 16	08 02	09 12	10 21	11 30
40	19 25	19 56	20 34	07 58	09 12	10 25	11 37
45	19 40	20 14	20 58	07 55	09 13	10 30	11 46
S 50	19 57	20 37	21 30	07 51	09 14	10 36	11 57
52	20 05	20 48	21 47	07 48	09 14	10 39	12 02
54	20 15	21 01	22 08	07 46	09 15	10 42	12 08
56	20 25	21 16	22 37	07 44	09 15	10 45	12 14
58	20 37	21 34	23 23	07 41	09 15	10 49	12 21
S 60	20 51	21 56	////	07 38	09 16	10 53	12 29

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
22	11 21	11 29	12 11	02 04	14 31	18	90
23	11 37	11 45	12 12	02 56	15 22	19	82
24	11 53	12 00	12 12	03 48	16 13	20	73

UT	ARIES	VENUS −4.4		MARS +1.1		JUPITER −2.2		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
25 00	123 57.5	226 08.9	S19 56.9	174 10.8	S19 31.7	123 06.2	S 0 55.4	287 06.8	S 4 26.1
01	139 00.0	241 08.5	57.2	189 11.2	31.2	138 08.3	55.2	302 09.3	26.1
02	154 02.5	256 08.0	57.6	204 11.7	30.7	153 10.3	55.0	317 11.7	26.1
03	169 04.9	271 07.6	57.9	219 12.1	30.2	168 12.4	54.8	332 14.2	26.0
04	184 07.4	286 07.2	58.2	234 12.6	29.7	183 14.4	54.6	347 16.6	26.0
05	199 09.9	301 06.7	58.6	249 13.0	29.2	198 16.4	54.4	2 19.1	26.0
06	214 12.3	316 06.3	S19 58.9	264 13.5	S19 28.7	213 18.5	S 0 54.2	17 21.5	S 4 26.0
07	229 14.8	331 05.8	59.3	279 13.9	28.2	228 20.5	54.0	32 24.0	26.0
08	244 17.3	346 05.4	59.6	294 14.4	27.7	243 22.6	53.8	47 26.5	26.0
T 09	259 19.7	1 04.9	19 59.9	309 14.8	27.2	258 24.6	53.6	62 28.9	26.0
U 10	274 22.2	16 04.5	20 00.3	324 15.3	26.7	273 26.6	53.5	77 31.4	26.0
E 11	289 24.7	31 04.0	00.6	339 15.7	26.2	288 28.7	53.3	92 33.8	26.0
S 12	304 27.1	46 03.6	S20 00.9	354 16.2	S19 25.7	303 30.7	S 0 53.1	107 36.3	S 4 26.0
D 13	319 29.6	61 03.1	01.3	9 16.6	25.2	318 32.8	52.9	122 38.7	26.0
A 14	334 32.0	76 02.7	01.6	24 17.1	24.7	333 34.8	52.7	137 41.2	25.9
Y 15	349 34.5	91 02.2	01.9	39 17.5	24.2	348 36.9	52.5	152 43.7	25.9
16	4 37.0	106 01.8	02.3	54 18.0	23.7	3 38.9	52.3	167 46.1	25.9
17	19 39.4	121 01.3	02.6	69 18.4	23.2	18 40.9	52.1	182 48.6	25.9
18	34 41.9	136 00.9	S20 02.9	84 18.9	S19 22.7	33 43.0	S 0 51.9	197 51.0	S 4 25.9
19	49 44.4	151 00.4	03.2	99 19.3	22.2	48 45.0	51.7	212 53.5	25.9
20	64 46.8	166 00.0	03.6	114 19.8	21.7	63 47.1	51.5	227 55.9	25.9
21	79 49.3	180 59.5	03.9	129 20.2	21.2	78 49.1	51.4	242 58.4	25.9
22	94 51.8	195 59.1	04.2	144 20.7	20.7	93 51.1	51.2	258 00.9	25.9
23	109 54.2	210 58.6	04.5	159 21.1	20.2	108 53.2	51.0	273 03.3	25.9
26 00	124 56.7	225 58.2	S20 04.9	174 21.6	S19 19.7	123 55.2	S 0 50.8	288 05.8	S 4 25.8
01	139 59.2	240 57.7	05.2	189 22.0	19.2	138 57.2	50.6	303 08.2	25.8
02	155 01.6	255 57.3	05.5	204 22.5	18.7	153 59.3	50.4	318 10.7	25.8
03	170 04.1	270 56.8	05.8	219 22.9	18.2	169 01.3	50.2	333 13.2	25.8
04	185 06.5	285 56.3	06.2	234 23.4	17.7	184 03.4	50.0	348 15.6	25.8
05	200 09.0	300 55.9	06.5	249 23.9	17.2	199 05.4	49.8	3 18.1	25.8
06	215 11.5	315 55.4	S20 06.8	264 24.3	S19 16.7	214 07.4	S 0 49.6	18 20.5	S 4 25.8
W 07	230 13.9	330 55.0	07.1	279 24.8	16.2	229 09.5	49.4	33 23.0	25.8
E 08	245 16.4	345 54.5	07.4	294 25.2	15.7	244 11.5	49.2	48 25.4	25.8
D 09	260 18.9	0 54.0	07.8	309 25.7	15.2	259 13.5	49.0	63 27.9	25.7
N 10	275 21.3	15 53.6	08.1	324 26.1	14.7	274 15.6	48.9	78 30.4	25.7
E 11	290 23.8	30 53.1	08.4	339 26.6	14.2	289 17.6	48.7	93 32.8	25.7
S 12	305 26.3	45 52.7	S20 08.7	354 27.0	S19 13.6	304 19.7	S 0 48.5	108 35.3	S 4 25.7
D 13	320 28.7	60 52.2	09.0	9 27.5	13.1	319 21.7	48.3	123 37.8	25.7
A 14	335 31.2	75 51.7	09.3	24 27.9	12.6	334 23.7	48.1	138 40.2	25.7
Y 15	350 33.6	90 51.3	09.7	39 28.4	12.1	349 25.8	47.9	153 42.7	25.7
16	5 36.1	105 50.8	10.0	54 28.8	11.6	4 27.8	47.7	168 45.1	25.7
17	20 38.6	120 50.3	10.3	69 29.3	11.1	19 29.8	47.5	183 47.6	25.7
18	35 41.0	135 49.9	S20 10.6	84 29.8	S19 10.6	34 31.9	S 0 47.3	198 50.1	S 4 25.6
19	50 43.5	150 49.4	10.9	99 30.2	10.1	49 33.9	47.1	213 52.5	25.6
20	65 46.0	165 48.9	11.2	114 30.7	09.6	64 35.9	46.9	228 55.0	25.6
21	80 48.4	180 48.5	11.5	129 31.1	09.1	79 38.0	46.7	243 57.4	25.6
22	95 50.9	195 48.0	11.8	144 31.6	08.5	94 40.0	46.5	258 59.9	25.6
23	110 53.4	210 47.5	12.1	159 32.0	08.0	109 42.1	46.3	274 02.4	25.6
27 00	125 55.8	225 47.1	S20 12.4	174 32.5	S19 07.5	124 44.1	S 0 46.1	289 04.8	S 4 25.6
01	140 58.3	240 46.6	12.8	189 33.0	07.0	139 46.1	46.0	304 07.3	25.6
02	156 00.8	255 46.1	13.1	204 33.4	06.5	154 48.2	45.8	319 09.8	25.5
03	171 03.2	270 45.6	13.4	219 33.9	06.0	169 50.2	45.6	334 12.2	25.5
04	186 05.7	285 45.2	13.7	234 34.3	05.5	184 52.2	45.4	349 14.7	25.5
05	201 08.1	300 44.7	14.0	249 34.8	04.9	199 54.3	45.2	4 17.1	25.5
06	216 10.6	315 44.2	S20 14.3	264 35.2	S19 04.4	214 56.3	S 0 45.0	19 19.6	S 4 25.5
07	231 13.1	330 43.7	14.6	279 35.7	03.9	229 58.3	44.8	34 22.1	25.5
T 08	246 15.5	345 43.3	14.9	294 36.2	03.4	245 00.4	44.6	49 24.5	25.5
H 09	261 18.0	0 42.8	15.2	309 36.6	02.9	260 02.4	44.4	64 27.0	25.5
U 10	276 20.5	15 42.3	15.5	324 37.1	02.4	275 04.4	44.2	79 29.5	25.4
R 11	291 22.9	30 41.8	15.8	339 37.5	01.9	290 06.5	44.0	94 31.9	25.4
S 12	306 25.4	45 41.4	S20 16.1	354 38.0	S19 01.3	305 08.5	S 0 43.8	109 34.4	S 4 25.4
D 13	321 27.9	60 40.9	16.4	9 38.4	00.8	320 10.5	43.6	124 36.9	25.4
A 14	336 30.3	75 40.4	16.7	24 38.9	19 00.3	335 12.6	43.4	139 39.3	25.4
Y 15	351 32.8	90 39.9	17.0	39 39.4	18 59.8	350 14.6	43.2	154 41.8	25.4
16	6 35.3	105 39.5	17.3	54 39.8	59.3	5 16.6	43.0	169 44.3	25.4
17	21 37.7	120 39.0	17.5	69 40.3	58.7	20 18.7	42.8	184 46.7	25.4
18	36 40.2	135 38.5	S20 17.8	84 40.7	S18 58.2	35 20.7	S 0 42.6	199 49.2	S 4 25.3
19	51 42.6	150 38.0	18.1	99 41.2	57.7	50 22.7	42.5	214 51.7	25.3
20	66 45.1	165 37.5	18.4	114 41.7	57.2	65 24.8	42.3	229 54.1	25.3
21	81 47.6	180 37.0	18.7	129 42.1	56.7	80 26.8	42.1	244 56.6	25.3
22	96 50.0	195 36.6	19.0	144 42.6	56.1	95 28.8	41.9	259 59.1	25.3
23	111 52.5	210 36.1	19.3	159 43.0	55.6	110 30.8	41.7	275 01.5	25.3
	h m								
Mer. Pass.	15 37.7	*v* −0.5	*d* 0.3	*v* 0.5	*d* 0.5	*v* 2.0	*d* 0.2	*v* 2.5	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.5	S40 15.8
Achernar	335 28.0	S57 11.1
Acrux	173 11.0	S63 09.5
Adhara	255 13.5	S28 59.4
Aldebaran	290 51.1	N16 31.9
Alioth	166 21.9	N55 53.6
Alkaid	153 00.1	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.5	N26 40.4
Alpheratz	357 45.5	N29 09.3
Altair	62 10.2	N 8 53.9
Ankaa	353 17.5	S42 14.9
Antares	112 28.6	S26 27.3
Arcturus	145 57.2	N19 07.2
Atria	107 32.3	S69 02.6
Avior	234 18.1	S59 32.8
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.4	S52 42.3
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.3
Denebola	182 35.2	N14 30.3
Diphda	348 57.7	S17 55.6
Dubhe	193 53.1	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.4	N51 29.1
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.9
Gacrux	172 02.6	S57 10.4
Gienah	175 53.9	S17 36.3
Hadar	148 50.4	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.4	S34 22.7
Kochab	137 19.9	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.8	N 4 08.0
Menkent	148 09.6	S36 25.4
Miaplacidus	221 39.2	S69 45.8
Mirfak	308 42.7	N49 54.3
Nunki	76 00.7	S26 16.9
Peacock	53 22.4	S56 41.9
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.3	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.4	S 8 11.5
Rigil Kent.	139 54.2	S60 52.6
Sabik	102 14.7	S15 44.3
Schedar	349 42.8	N56 36.2
Shaula	96 24.5	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 33.0	S11 13.3
Suhail	222 53.3	S43 28.8
Vega	80 40.5	N38 47.5
Zuben'ubi	137 07.4	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	101 01.5	8 56
Mars	49 24.9	12 22
Jupiter	358 58.5	15 42
Saturn	163 09.1	4 47

2011 JANUARY 25, 26, 27 (TUES., WED., THURS.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
25 00	176 58.1	S19 06.0	292 37.4	9.8	S10 23.9	13.3	59.5
01	191 58.0	05.4	307 06.2	9.7	10 37.2	13.3	59.5
02	206 57.8	04.8	321 34.9	9.7	10 50.5	13.2	59.5
03	221 57.7	04.2	336 03.6	9.7	11 03.7	13.1	59.5
04	236 57.5	03.6	350 32.3	9.7	11 16.8	13.0	59.4
05	251 57.4	02.9	5 01.0	9.7	11 29.8	12.9	59.4
06	266 57.2	S19 02.3	19 29.7	9.6	S11 42.7	12.9	59.4
07	281 57.1	01.7	33 58.3	9.6	11 55.6	12.8	59.4
08	296 57.0	01.1	48 26.9	9.6	12 08.4	12.7	59.4
09	311 56.8	19 00.5	62 55.5	9.5	12 21.1	12.7	59.3
10	326 56.7	18 59.9	77 24.0	9.5	12 33.8	12.5	59.3
11	341 56.5	59.3	91 52.5	9.5	12 46.3	12.5	59.3
12	356 56.4	S18 58.6	106 21.0	9.5	S12 58.8	12.4	59.3
13	11 56.2	58.0	120 49.5	9.4	13 11.2	12.3	59.2
14	26 56.1	57.4	135 17.9	9.5	13 23.5	12.2	59.2
15	41 56.0	56.8	149 46.4	9.3	13 35.7	12.2	59.2
16	56 55.8	56.2	164 14.7	9.4	13 47.9	12.0	59.2
17	71 55.7	55.6	178 43.1	9.3	13 59.9	12.0	59.1
18	86 55.5	S18 54.9	193 11.4	9.3	S14 11.9	11.8	59.1
19	101 55.4	54.3	207 39.7	9.2	14 23.7	11.8	59.1
20	116 55.2	53.7	222 07.9	9.3	14 35.5	11.7	59.1
21	131 55.1	53.1	236 36.2	9.1	14 47.2	11.6	59.0
22	146 55.0	52.5	251 04.3	9.2	14 58.8	11.4	59.0
23	161 54.8	51.8	265 32.5	9.1	15 10.2	11.4	59.0
26 00	176 54.7	S18 51.2	280 00.6	9.1	S15 21.6	11.3	59.0
01	191 54.5	50.6	294 28.7	9.1	15 32.9	11.2	58.9
02	206 54.4	50.0	308 56.8	9.0	15 44.1	11.1	58.9
03	221 54.3	49.3	323 24.8	9.0	15 55.2	11.0	58.9
04	236 54.1	48.7	337 52.8	9.0	16 06.2	10.9	58.9
05	251 54.0	48.1	352 20.8	8.9	16 17.1	10.8	58.8
06	266 53.9	S18 47.5	6 48.7	8.9	S16 27.9	10.7	58.8
07	281 53.7	46.8	21 16.6	8.8	16 38.6	10.6	58.8
08	296 53.6	46.2	35 44.4	8.9	16 49.2	10.5	58.8
09	311 53.4	45.6	50 12.3	8.7	16 59.7	10.3	58.7
10	326 53.3	45.0	64 40.0	8.8	17 10.0	10.3	58.7
11	341 53.2	44.3	79 07.8	8.7	17 20.3	10.1	58.7
12	356 53.0	S18 43.7	93 35.5	8.7	S17 30.4	10.1	58.7
13	11 52.9	43.1	108 03.2	8.7	17 40.5	9.9	58.6
14	26 52.8	42.4	122 30.9	8.6	17 50.4	9.8	58.6
15	41 52.6	41.8	136 58.5	8.6	18 00.2	9.8	58.6
16	56 52.5	41.2	151 26.1	8.5	18 10.0	9.6	58.6
17	71 52.4	40.5	165 53.6	8.5	18 19.6	9.4	58.5
18	86 52.2	S18 39.9	180 21.1	8.5	S18 29.0	9.4	58.5
19	101 52.1	39.3	194 48.6	8.4	18 38.4	9.3	58.5
20	116 52.0	38.6	209 16.0	8.5	18 47.7	9.1	58.5
21	131 51.8	38.0	223 43.5	8.3	18 56.8	9.0	58.4
22	146 51.7	37.4	238 10.8	8.4	19 05.8	8.9	58.4
23	161 51.6	36.7	252 38.2	8.3	19 14.7	8.8	58.4
27 00	176 51.4	S18 36.1	267 05.5	8.3	S19 23.5	8.7	58.4
01	191 51.3	35.5	281 32.8	8.2	19 32.2	8.5	58.3
02	206 51.2	34.8	296 00.0	8.2	19 40.7	8.4	58.3
03	221 51.0	34.2	310 27.2	8.2	19 49.1	8.3	58.3
04	236 50.9	33.5	324 54.4	8.2	19 57.4	8.2	58.3
05	251 50.8	32.9	339 21.6	8.1	20 05.6	8.0	58.2
06	266 50.6	S18 32.3	353 48.7	8.1	S20 13.6	8.0	58.2
07	281 50.5	31.6	8 15.8	8.1	20 21.6	7.7	58.2
08	296 50.4	31.0	22 42.9	8.0	20 29.3	7.7	58.2
09	311 50.3	30.3	37 09.9	8.0	20 37.0	7.6	58.1
10	326 50.1	29.7	51 36.9	8.0	20 44.6	7.4	58.1
11	341 50.0	29.1	66 03.9	7.9	20 52.0	7.3	58.1
12	356 49.9	S18 28.4	80 30.8	7.9	S20 59.3	7.1	58.1
13	11 49.8	27.8	94 57.7	7.9	21 06.4	7.1	58.0
14	26 49.6	27.1	109 24.6	7.9	21 13.5	6.9	58.0
15	41 49.5	26.5	123 51.5	7.8	21 20.4	6.7	58.0
16	56 49.4	25.8	138 18.3	7.9	21 27.1	6.7	58.0
17	71 49.2	25.2	152 45.2	7.8	21 33.8	6.5	57.9
18	86 49.1	S18 24.5	167 12.0	7.7	S21 40.3	6.4	57.9
19	101 49.0	23.9	181 38.7	7.8	21 46.7	6.2	57.9
20	116 48.9	23.2	196 05.5	7.7	21 52.9	6.1	57.9
21	131 48.7	22.6	210 32.2	7.7	21 59.0	6.0	57.8
22	146 48.6	21.9	224 58.9	7.7	22 05.0	5.8	57.8
23	161 48.5	21.3	239 25.6	7.6	S22 10.8	5.7	57.8
	SD 16.3	d 0.6	SD	16.1		16.0	15.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 25	Moonrise 26	Moonrise 27	Moonrise 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 31	09 06	11 47	00 55	03 41	▬	▬
N 70	07 20	08 43	10 23	00 36	02 55	▬	▬
68	07 12	08 25	09 45	00 21	02 25	04 44	▬
66	07 04	08 10	09 18	00 09	02 03	04 02	06 06
64	06 58	07 58	08 58	25 46	01 46	03 33	05 16
62	06 52	07 48	08 42	25 32	01 32	03 11	04 45
60	06 47	07 39	08 28	25 20	01 20	02 54	04 21
N 58	06 42	07 31	08 16	25 10	01 10	02 39	04 02
56	06 38	07 24	08 06	25 01	01 01	02 27	03 47
54	06 34	07 17	07 57	24 53	00 53	02 16	03 33
52	06 30	07 12	07 49	24 46	00 46	02 06	03 22
50	06 27	07 06	07 42	24 39	00 39	01 58	03 11
45	06 19	06 55	07 27	24 26	00 26	01 40	02 50
N 40	06 12	06 45	07 14	24 15	00 15	01 25	02 32
35	06 06	06 36	07 03	24 05	00 05	01 13	02 18
30	05 59	06 28	06 54	23 57	25 02	01 02	02 05
20	05 47	06 14	06 37	23 43	24 43	00 43	01 44
N 10	05 35	06 00	06 23	23 31	24 28	00 28	01 25
0	05 22	05 47	06 09	23 19	24 13	00 13	01 08
S 10	05 07	05 33	05 55	23 08	23 58	24 50	00 50
20	04 49	05 17	05 40	22 56	23 42	24 32	00 32
30	04 25	04 57	05 23	22 42	23 24	24 11	00 11
35	04 11	04 45	05 13	22 34	23 14	23 59	24 48
40	03 53	04 31	05 01	22 25	23 02	23 44	24 33
45	03 30	04 13	04 47	22 15	22 48	23 28	24 14
S 50	02 59	03 51	04 31	22 02	22 32	23 07	23 52
52	02 42	03 40	04 23	21 57	22 24	22 58	23 41
54	02 23	03 28	04 14	21 50	22 15	22 47	23 28
56	01 57	03 14	04 04	21 43	22 05	22 34	23 14
58	01 17	02 57	03 52	21 35	21 54	22 20	22 57
S 60	////	02 35	03 39	21 26	21 41	22 03	22 37

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 25	Moonset 26	Moonset 27	Moonset 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	12 39	15 20	16 55	07 58	07 02	▬	▬
N 70	14 03	15 43	17 06	08 19	07 49	▬	▬
68	14 41	16 01	17 14	08 35	08 21	07 54	▬
66	15 08	16 16	17 22	08 49	08 44	08 38	08 29
64	15 28	16 28	17 28	09 00	09 02	09 07	09 20
62	15 44	16 38	17 34	09 10	09 17	09 30	09 51
60	15 58	16 47	17 39	09 18	09 30	09 48	10 15
N 58	16 09	16 55	17 43	09 25	09 41	10 03	10 34
56	16 19	17 02	17 48	09 32	09 51	10 16	10 50
54	16 28	17 08	17 51	09 38	10 00	10 27	11 04
52	16 36	17 14	17 55	09 43	10 07	10 37	11 16
50	16 43	17 19	17 58	09 48	10 14	10 46	11 26
45	16 59	17 31	18 06	09 58	10 29	11 05	11 48
N 40	17 11	17 40	18 13	10 07	10 41	11 21	12 06
35	17 22	17 49	18 20	10 14	10 52	11 34	12 21
30	17 32	17 57	18 26	10 21	11 01	11 46	12 34
20	17 48	18 11	18 38	10 32	11 17	12 05	12 57
N 10	18 02	18 25	18 50	10 42	11 31	12 23	13 16
0	18 16	18 38	19 03	10 52	11 44	12 39	13 34
S 10	18 30	18 52	19 18	11 01	11 58	12 55	13 52
20	18 45	19 08	19 36	11 11	12 12	13 12	14 12
30	19 02	19 28	19 59	11 23	12 28	13 32	14 34
35	19 12	19 40	20 14	11 30	12 38	13 44	14 47
40	19 23	19 54	20 31	11 37	12 48	13 58	15 03
45	19 37	20 11	20 54	11 46	13 01	14 13	15 21
S 50	19 53	20 33	21 25	11 57	13 17	14 33	15 43
52	20 01	20 43	21 40	12 02	13 24	14 43	15 54
54	20 10	20 55	22 00	12 08	13 32	14 53	16 06
56	20 20	21 09	22 25	12 14	13 42	15 05	16 20
58	20 31	21 26	23 02	12 21	13 52	15 19	16 37
S 60	20 44	21 47	////	12 29	14 04	15 35	16 57

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
25	12 07	12 14	12 12	04 39	17 05	21	62
26	12 21	12 28	12 12	05 32	17 59	22	51
27	12 34	12 40	12 13	06 26	18 53	23	40

UT	ARIES	VENUS −4.4		MARS +1.1		JUPITER −2.2		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
28 00	126 55.0	225 35.6	S20 19.6	174 43.5	S18 55.1	125 32.9	S 0 41.5	290 04.0	S 4 25.3
01	141 57.4	240 35.1	19.9	189 44.0	54.6	140 34.9	41.3	305 06.5	25.2
02	156 59.9	255 34.6	20.2	204 44.4	54.1	155 36.9	41.1	320 08.9	25.2
03	172 02.4	270 34.1	20.4	219 44.9	53.5	170 39.0	40.9	335 11.4	25.2
04	187 04.8	285 33.7	20.7	234 45.3	53.0	185 41.0	40.7	350 13.9	25.2
05	202 07.3	300 33.2	21.0	249 45.8	52.5	200 43.0	40.5	5 16.3	25.2
06	217 09.8	315 32.7	S20 21.3	264 46.3	S18 52.0	215 45.1	S 0 40.3	20 18.8	S 4 25.2
07	232 12.2	330 32.2	21.6	279 46.7	51.4	230 47.1	40.1	35 21.3	25.2
08	247 14.7	345 31.7	21.9	294 47.2	50.9	245 49.1	39.9	50 23.7	25.1
F 09	262 17.1	0 31.2	22.1	309 47.7	50.4	260 51.2	39.7	65 26.2	25.1
R 10	277 19.6	15 30.7	22.4	324 48.1	49.9	275 53.2	39.5	80 28.7	25.1
I 11	292 22.1	30 30.2	22.7	339 48.6	49.3	290 55.2	39.3	95 31.1	25.1
D 12	307 24.5	45 29.7	S20 23.0	354 49.0	S18 48.8	305 57.2	S 0 39.1	110 33.6	S 4 25.1
A 13	322 27.0	60 29.3	23.3	9 49.5	48.3	320 59.3	38.9	125 36.1	25.1
Y 14	337 29.5	75 28.8	23.5	24 50.0	47.8	336 01.3	38.7	140 38.5	25.1
15	352 31.9	90 28.3	23.8	39 50.4	47.2	351 03.3	38.5	155 41.0	25.0
16	7 34.4	105 27.8	24.1	54 50.9	46.7	6 05.4	38.3	170 43.5	25.0
17	22 36.9	120 27.3	24.4	69 51.4	46.2	21 07.4	38.1	185 45.9	25.0
18	37 39.3	135 26.8	S20 24.6	84 51.8	S18 45.7	36 09.4	S 0 38.0	200 48.4	S 4 25.0
19	52 41.8	150 26.3	24.9	99 52.3	45.1	51 11.4	37.8	215 50.9	25.0
20	67 44.2	165 25.8	25.2	114 52.8	44.6	66 13.5	37.6	230 53.4	25.0
21	82 46.7	180 25.3	25.5	129 53.2	44.1	81 15.5	37.4	245 55.8	25.0
22	97 49.2	195 24.8	25.7	144 53.7	43.5	96 17.5	37.2	260 58.3	24.9
23	112 51.6	210 24.3	26.0	159 54.1	43.0	111 19.5	37.0	276 00.8	24.9
29 00	127 54.1	225 23.8	S20 26.3	174 54.6	S18 42.5	126 21.6	S 0 36.8	291 03.2	S 4 24.9
01	142 56.6	240 23.3	26.5	189 55.1	42.0	141 23.6	36.6	306 05.7	24.9
02	157 59.0	255 22.8	26.8	204 55.5	41.4	156 25.6	36.4	321 08.2	24.9
03	173 01.5	270 22.3	27.1	219 56.0	40.9	171 27.7	36.2	336 10.7	24.9
04	188 04.0	285 21.8	27.3	234 56.5	40.4	186 29.7	36.0	351 13.1	24.8
05	203 06.4	300 21.3	27.6	249 56.9	39.8	201 31.7	35.8	6 15.6	24.8
06	218 08.9	315 20.8	S20 27.9	264 57.4	S18 39.3	216 33.7	S 0 35.6	21 18.1	S 4 24.8
07	233 11.4	330 20.3	28.1	279 57.9	38.8	231 35.8	35.4	36 20.5	24.8
S 08	248 13.8	345 19.8	28.4	294 58.3	38.2	246 37.8	35.2	51 23.0	24.8
A 09	263 16.3	0 19.3	28.7	309 58.8	37.7	261 39.8	35.0	66 25.5	24.8
T 10	278 18.7	15 18.8	28.9	324 59.3	37.2	276 41.8	34.8	81 28.0	24.8
U 11	293 21.2	30 18.3	29.2	339 59.7	36.6	291 43.9	34.6	96 30.4	24.7
R 12	308 23.7	45 17.8	S20 29.5	355 00.2	S18 36.1	306 45.9	S 0 34.4	111 32.9	S 4 24.7
D 13	323 26.1	60 17.3	29.7	10 00.7	35.6	321 47.9	34.2	126 35.4	24.7
A 14	338 28.6	75 16.8	30.0	25 01.1	35.0	336 49.9	34.0	141 37.9	24.7
Y 15	353 31.1	90 16.3	30.2	40 01.6	34.5	351 52.0	33.8	156 40.3	24.7
16	8 33.5	105 15.8	30.5	55 02.1	34.0	6 54.0	33.6	171 42.8	24.7
17	23 36.0	120 15.3	30.7	70 02.5	33.4	21 56.0	33.4	186 45.3	24.6
18	38 38.5	135 14.8	S20 31.0	85 03.0	S18 32.9	36 58.0	S 0 33.2	201 47.7	S 4 24.6
19	53 40.9	150 14.3	31.2	100 03.5	32.3	52 00.1	33.0	216 50.2	24.6
20	68 43.4	165 13.8	31.5	115 03.9	31.8	67 02.1	32.8	231 52.7	24.6
21	83 45.9	180 13.2	31.8	130 04.4	31.3	82 04.1	32.6	246 55.2	24.6
22	98 48.3	195 12.7	32.0	145 04.9	30.7	97 06.1	32.4	261 57.6	24.6
23	113 50.8	210 12.2	32.3	160 05.3	30.2	112 08.2	32.2	277 00.1	24.5
30 00	128 53.2	225 11.7	S20 32.5	175 05.8	S18 29.7	127 10.2	S 0 32.0	292 02.6	S 4 24.5
01	143 55.7	240 11.2	32.8	190 06.3	29.1	142 12.2	31.8	307 05.1	24.5
02	158 58.2	255 10.7	33.0	205 06.7	28.6	157 14.2	31.6	322 07.5	24.5
03	174 00.6	270 10.2	33.3	220 07.2	28.0	172 16.2	31.4	337 10.0	24.5
04	189 03.1	285 09.7	33.5	235 07.7	27.5	187 18.3	31.2	352 12.5	24.4
05	204 05.6	300 09.2	33.8	250 08.2	27.0	202 20.3	31.0	7 15.0	24.4
06	219 08.0	315 08.6	S20 34.0	265 08.6	S18 26.4	217 22.3	S 0 30.8	22 17.5	S 4 24.4
07	234 10.5	330 08.1	34.2	280 09.1	25.9	232 24.3	30.6	37 19.9	24.4
08	249 13.0	345 07.6	34.5	295 09.6	25.3	247 26.4	30.4	52 22.4	24.4
S 09	264 15.4	0 07.1	34.7	310 10.0	24.8	262 28.4	30.2	67 24.9	24.4
U 10	279 17.9	15 06.6	35.0	325 10.5	24.3	277 30.4	30.0	82 27.4	24.3
N 11	294 20.4	30 06.1	35.2	340 11.0	23.7	292 32.4	29.8	97 29.8	24.3
D 12	309 22.8	45 05.6	S20 35.5	355 11.5	S18 23.2	307 34.4	S 0 29.6	112 32.3	S 4 24.3
A 13	324 25.3	60 05.0	35.7	10 11.9	22.6	322 36.5	29.4	127 34.8	24.3
Y 14	339 27.7	75 04.5	35.9	25 12.4	22.1	337 38.5	29.2	142 37.3	24.3
15	354 30.2	90 04.0	36.2	40 12.9	21.5	352 40.5	29.0	157 39.7	24.3
16	9 32.7	105 03.5	36.4	55 13.3	21.0	7 42.5	28.8	172 42.2	24.2
17	24 35.1	120 03.0	36.6	70 13.8	20.5	22 44.6	28.7	187 44.7	24.2
18	39 37.6	135 02.4	S20 36.9	85 14.3	S18 19.9	37 46.6	S 0 28.5	202 47.2	S 4 24.2
19	54 40.1	150 01.9	37.1	100 14.8	19.4	52 48.6	28.3	217 49.7	24.2
20	69 42.5	165 01.4	37.3	115 15.2	18.8	67 50.6	28.1	232 52.1	24.2
21	84 45.0	180 00.9	37.6	130 15.7	18.3	82 52.6	27.9	247 54.6	24.1
22	99 47.5	195 00.4	37.8	145 16.2	17.7	97 54.7	27.7	262 57.1	24.1
23	114 49.9	209 59.8	38.0	160 16.6	17.2	112 56.7	27.5	277 59.6	24.1
	h m								
Mer. Pass.	15 25.9	v −0.5	d 0.3	v 0.5	d 0.5	v 2.0	d 0.2	v 2.5	d 0.0

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.5	S40 15.8
Achernar	335 28.0	S57 11.1
Acrux	173 10.9	S63 09.5
Adhara	255 13.5	S28 59.4
Aldebaran	290 51.1	N16 31.9
Alioth	166 21.8	N55 53.6
Alkaid	153 00.1	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.5	N26 40.4
Alpheratz	357 45.5	N29 09.3
Altair	62 10.2	N 8 53.9
Ankaa	353 17.5	S42 14.9
Antares	112 28.5	S26 27.3
Arcturus	145 57.2	N19 07.2
Atria	107 32.3	S69 02.6
Avior	234 18.1	S59 32.8
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.4	S52 42.3
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.3
Denebola	182 35.1	N14 30.3
Diphda	348 57.7	S17 55.6
Dubhe	193 53.1	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.3	N51 29.1
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.9
Gacrux	172 02.6	S57 10.4
Gienah	175 53.9	S17 36.3
Hadar	148 50.3	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.4	S34 22.7
Kochab	137 19.9	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.8	N 4 08.0
Menkent	148 09.6	S36 25.4
Miaplacidus	221 39.2	S69 45.8
Mirfak	308 42.7	N49 54.3
Nunki	76 00.7	S26 16.9
Peacock	53 22.4	S56 41.9
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.3	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.4	S 8 11.5
Rigil Kent.	139 54.1	S60 52.6
Sabik	102 14.7	S15 44.3
Schedar	349 42.8	N56 36.2
Shaula	96 24.5	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 32.9	S11 13.3
Suhail	222 53.3	S43 28.8
Vega	80 40.5	N38 47.5
Zuben'ubi	137 07.3	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	97 29.7	8 59
Mars	47 00.5	12 20
Jupiter	358 27.5	15 32
Saturn	163 09.1	4 35

FRIDAY SATURDAY SUNDAY

UT	SUN				MOON						Lat.	Twilight		Sunrise	Moonrise			
		GHA		Dec		GHA	v		Dec	d	HP		Naut.	Civil		28	29	30	31
d	h	°	′	°	′	°	′	′	°	′	′	′	°	h m	h m	h m	h m	h m	h m	h m
28	00	176	48.4	S18	20.6	253	52.2	7.7	S22	16.5	5.6	57.8	N 72	07 21	08 53	10 59	▬	▬	▬	▬
	01	191	48.3		20.0	268	18.9	7.6	22	22.1	5.4	57.7	N 70	07 12	08 32	10 04	▬	▬	▬	▬
	02	206	48.1		19.3	282	45.5	7.6	22	27.5	5.3	57.7	68	07 04	08 16	09 32	▬	▬	▬	▬
	03	221	48.0	. .	18.7	297	12.1	7.6	22	32.8	5.2	57.7	66	06 57	08 02	09 08	06 06	▬	09 02	08 36
	04	236	47.9		18.0	311	38.7	7.6	22	38.0	5.0	57.7	64	06 52	07 51	08 49	05 16	06 42	07 33	07 54
	05	251	47.8		17.4	326	05.3	7.5	22	43.0	4.9	57.6	62	06 47	07 42	08 34	04 45	06 02	06 55	07 25
													60	06 42	07 33	08 22	04 21	05 35	06 29	07 03
	06	266	47.6	S18	16.7	340	31.8	7.6	S22	47.9	4.7	57.6	N 58	06 38	07 26	08 11	04 02	05 13	06 08	06 46
	07	281	47.5		16.1	354	58.4	7.5	22	52.6	4.7	57.6	56	06 34	07 19	08 01	03 47	04 56	05 50	06 31
	08	296	47.4		15.4	9	24.9	7.5	22	57.3	4.4	57.6	54	06 30	07 13	07 53	03 33	04 41	05 36	06 18
F	09	311	47.3	. .	14.8	23	51.4	7.6	23	01.7	4.4	57.5	52	06 27	07 08	07 45	03 22	04 28	05 23	06 06
R	10	326	47.2		14.1	38	18.0	7.5	23	06.1	4.2	57.5	50	06 24	07 03	07 38	03 11	04 17	05 12	05 56
I	11	341	47.0		13.4	52	44.5	7.5	23	10.3	4.0	57.5	45	06 17	06 52	07 24	02 50	03 53	04 49	05 35
D	12	356	46.9	S18	12.8	67	11.0	7.5	S23	14.3	3.9	57.5	N 40	06 10	06 43	07 12	02 32	03 35	04 30	05 17
A	13	11	46.8		12.1	81	37.5	7.4	23	18.2	3.8	57.4	35	06 04	06 34	07 01	02 18	03 19	04 14	05 03
Y	14	26	46.7		11.5	96	03.9	7.5	23	22.0	3.6	57.4	30	05 58	06 27	06 52	02 05	03 05	04 01	04 50
	15	41	46.6	. .	10.8	110	30.4	7.5	23	25.6	3.5	57.4	20	05 47	06 13	06 36	01 44	02 42	03 37	04 29
	16	56	46.4		10.1	124	56.9	7.5	23	29.1	3.4	57.4	N 10	05 35	06 01	06 23	01 25	02 22	03 17	04 10
	17	71	46.3		09.5	139	23.4	7.4	23	32.5	3.2	57.3	0	05 22	05 48	06 10	01 08	02 03	02 58	03 52
	18	86	46.2	S18	08.8	153	49.8	7.5	S23	35.7	3.1	57.3	S 10	05 08	05 34	05 56	00 50	01 45	02 40	03 35
	19	101	46.1		08.2	168	16.3	7.5	23	38.8	2.9	57.3	20	04 51	05 19	05 42	00 32	01 25	02 20	03 16
	20	116	46.0		07.5	182	42.8	7.4	23	41.7	2.8	57.3	30	04 28	05 00	05 26	00 11	01 02	01 57	02 54
	21	131	45.9	. .	06.8	197	09.2	7.5	23	44.5	2.7	57.2	35	04 14	04 48	05 16	24 48	00 48	01 43	02 41
	22	146	45.7		06.2	211	35.7	7.5	23	47.2	2.5	57.2	40	03 57	04 35	05 05	24 33	00 33	01 27	02 26
	23	161	45.6		05.5	226	02.2	7.4	23	49.7	2.3	57.2	45	03 35	04 18	04 52	24 14	00 14	01 09	02 09
29	00	176	45.5	S18	04.8	240	28.6	7.5	S23	52.0	2.3	57.2	S 50	03 06	03 57	04 36	23 52	24 45	00 45	01 47
	01	191	45.4		04.2	254	55.1	7.5	23	54.3	2.1	57.1	52	02 51	03 47	04 28	23 41	24 34	00 34	01 37
	02	206	45.3		03.5	269	21.6	7.5	23	56.4	1.9	57.1	54	02 32	03 35	04 20	23 28	24 21	00 21	01 25
	03	221	45.2	. .	02.8	283	48.1	7.5	23	58.3	1.8	57.1	56	02 09	03 22	04 10	23 14	24 07	00 07	01 11
	04	236	45.1		02.2	298	14.6	7.5	24	00.1	1.7	57.1	58	01 36	03 06	04 00	22 57	23 49	24 56	00 56
	05	251	44.9		01.5	312	41.1	7.6	24	01.8	1.5	57.1	S 60	////	02 46	03 47	22 37	23 28	24 37	00 37
	06	266	44.8	S18	00.8	327	07.7	7.5	S24	03.3	1.4	57.0								
	07	281	44.7	18	00.2	341	34.2	7.6	24	04.7	1.2	57.0	Lat.	Sunset	Twilight		Moonset			
S	08	296	44.6	17	59.5	356	00.8	7.6	24	05.9	1.1	57.0			Civil	Naut.	28	29	30	31
A	09	311	44.5	. .	58.8	10	27.4	7.5	24	07.0	1.0	57.0								
T	10	326	44.4		58.2	24	53.9	7.7	24	08.0	0.8	56.9	°	h m	h m	h m	h m	h m	h m	h m
U	11	341	44.3		57.5	39	20.6	7.6	24	08.8	0.7	56.9	N 72	13 28	15 34	17 07	▬	▬	▬	▬
R	12	356	44.2	S17	56.8	53	47.2	7.6	S24	09.5	0.6	56.9	N 70	14 23	15 55	17 16	▬	▬	▬	▬
D	13	11	44.1		56.1	68	13.8	7.7	24	10.1	0.4	56.9	68	14 55	16 11	17 23	▬	▬	▬	▬
A	14	26	43.9		55.5	82	40.5	7.7	24	10.5	0.2	56.8	66	15 19	16 25	17 30	08 29	▬	09 24	11 41
Y	15	41	43.8	. .	54.8	97	07.2	7.7	24	10.7	0.2	56.8	64	15 38	16 36	17 36	09 20	09 50	10 54	12 23
	16	56	43.7		54.1	111	33.9	7.7	24	10.9	0.1	56.8	62	15 53	16 45	17 41	09 51	10 30	11 31	12 51
	17	71	43.6		53.5	126	00.6	7.8	24	10.8	0.1	56.8	60	16 05	16 54	17 45	10 15	10 57	11 57	13 12
	18	86	43.5	S17	52.8	140	27.4	7.8	S24	10.7	0.3	56.8	N 58	16 16	17 01	17 49	10 34	11 18	12 18	13 30
	19	101	43.4		52.1	154	54.2	7.8	24	10.4	0.4	56.7	56	16 26	17 08	17 53	10 50	11 36	12 35	13 45
	20	116	43.3		51.4	169	21.0	7.9	24	10.0	0.6	56.7	54	16 34	17 13	17 56	11 04	11 51	12 50	13 57
	21	131	43.2	. .	50.8	183	47.9	7.9	24	09.4	0.7	56.7	52	16 42	17 19	18 00	11 16	12 04	13 02	14 08
	22	146	43.1		50.1	198	14.8	7.9	24	08.7	0.8	56.7	50	16 48	17 24	18 03	11 26	12 15	13 13	14 18
	23	161	43.0		49.4	212	41.7	7.9	24	07.9	1.0	56.6	45	17 03	17 35	18 10	11 48	12 39	13 36	14 39
30	00	176	42.9	S17	48.7	227	08.6	8.0	S24	06.9	1.1	56.6	N 40	17 15	17 44	18 16	12 06	12 58	13 55	14 56
	01	191	42.8		48.0	241	35.6	8.0	24	05.8	1.3	56.6	35	17 25	17 52	18 22	12 21	13 14	14 10	15 10
	02	206	42.6		47.4	256	02.6	8.1	24	04.5	1.3	56.6	30	17 34	17 59	18 28	12 34	13 27	14 24	15 22
	03	221	42.5	. .	46.7	270	29.7	8.1	24	03.2	1.5	56.6	20	17 50	18 13	18 40	12 57	13 51	14 46	15 42
	04	236	42.4		46.0	284	56.8	8.1	24	01.7	1.7	56.5	N 10	18 04	18 26	18 51	13 16	14 11	15 06	16 00
	05	251	42.3		45.3	299	23.9	8.2	24	00.0	1.8	56.5	0	18 17	18 38	19 04	13 34	14 30	15 25	16 17
	06	266	42.2	S17	44.6	313	51.1	8.2	S23	58.2	1.9	56.5	S 10	18 30	18 52	19 18	13 52	14 49	15 43	16 34
	07	281	42.1		44.0	328	18.3	8.3	23	56.3	2.0	56.5	20	18 44	19 07	19 35	14 12	15 09	16 02	16 51
	08	296	42.0		43.3	342	45.6	8.3	23	54.3	2.2	56.4	30	19 00	19 26	19 57	14 34	15 32	16 25	17 12
S	09	311	41.9	. .	42.6	357	12.9	8.3	23	52.1	2.3	56.4	35	19 10	19 37	20 11	14 47	15 46	16 38	17 24
U	10	326	41.8		41.9	11	40.2	8.4	23	49.8	2.5	56.4	40	19 21	19 51	20 28	15 03	16 02	16 53	17 37
N	11	341	41.7		41.2	26	07.6	8.4	23	47.3	2.5	56.4	45	19 34	20 07	20 50	15 21	16 20	17 11	17 53
D	12	356	41.6	S17	40.5	40	35.0	8.5	S23	44.8	2.7	56.4	S 50	19 49	20 28	21 18	15 43	16 44	17 33	18 13
A	13	11	41.5		39.9	55	02.5	8.5	23	42.1	2.9	56.3	52	19 57	20 38	21 33	15 54	16 55	17 44	18 22
Y	14	26	41.4		39.2	69	30.0	8.6	23	39.2	2.9	56.3	54	20 05	20 49	21 51	16 06	17 08	17 56	18 32
	15	41	41.3	. .	38.5	83	57.6	8.6	23	36.3	3.1	56.3	56	20 14	21 03	22 14	16 20	17 22	18 10	18 44
	16	56	41.2		37.8	98	25.2	8.7	23	33.2	3.2	56.3	58	20 25	21 18	22 45	16 37	17 40	18 26	18 57
	17	71	41.1		37.1	112	52.9	8.7	23	30.0	3.3	56.3	S 60	20 37	21 37	23 47	16 57	18 01	18 45	19 13
	18	86	41.0	S17	36.4	127	20.6	8.8	S23	26.7	3.5	56.2			SUN			MOON		
	19	101	40.9		35.7	141	48.4	8.9	23	23.2	3.6	56.2	Day	Eqn. of Time		Mer.	Mer. Pass.		Age	Phase
	20	116	40.8		35.0	156	16.3	8.9	23	19.6	3.7	56.2		00^h	12^h	Pass.	Upper	Lower		
	21	131	40.7	. .	34.4	170	44.2	8.9	23	15.9	3.8	56.2	d	m s	m s	h m	h m	h m	d %	
	22	146	40.6		33.7	185	12.1	9.0	23	12.1	4.0	56.1	28	12 46	12 52	12 13	07 21	19 49	24 29	
	23	161	40.5		33.0	199	40.1	9.1	S23	08.1	4.1	56.1	29	12 58	13 03	12 13	08 17	20 44	25 20	
		SD	16.3	d	0.7	SD		15.7		15.5		15.4	30	13 08	13 13	12 13	09 12	21 38	26 13	

UT	ARIES	VENUS −4.3		MARS +1.1		JUPITER −2.2		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
31 00	129 52.4	224 59.3	S20 38.3	175 17.1	S18 16.6	127 58.7	S 0 27.3	293 02.1	S 4 24.1
01	144 54.9	239 58.8	38.5	190 17.6	16.1	143 00.7	27.1	308 04.5	24.1
02	159 57.3	254 58.3	38.7	205 18.1	15.5	158 02.7	26.9	323 07.0	24.0
03	174 59.8	269 57.7	39.0	220 18.5	15.0	173 04.8	26.7	338 09.5	24.0
04	190 02.2	284 57.2	39.2	235 19.0	14.4	188 06.8	26.5	353 12.0	24.0
05	205 04.7	299 56.7	39.4	250 19.5	13.9	203 08.8	26.3	8 14.5	24.0
06	220 07.2	314 56.2	S20 39.6	265 20.0	S18 13.3	218 10.8	S 0 26.1	23 16.9	S 4 24.0
07	235 09.6	329 55.6	39.9	280 20.4	12.8	233 12.8	25.9	38 19.4	24.0
08	250 12.1	344 55.1	40.1	295 20.9	12.2	248 14.8	25.7	53 21.9	23.9
M 09	265 14.6	359 54.6	40.3	310 21.4	11.7	263 16.9	25.5	68 24.4	23.9
O 10	280 17.0	14 54.1	40.5	325 21.9	11.1	278 18.9	25.3	83 26.9	23.9
N 11	295 19.5	29 53.5	40.8	340 22.3	10.6	293 20.9	25.1	98 29.3	23.9
D 12	310 22.0	44 53.0	S20 41.0	355 22.8	S18 10.0	308 22.9	S 0 24.9	113 31.8	S 4 23.9
A 13	325 24.4	59 52.5	41.2	10 23.3	09.5	323 24.9	24.7	128 34.3	23.8
Y 14	340 26.9	74 51.9	41.4	25 23.8	08.9	338 27.0	24.4	143 36.8	23.8
15	355 29.3	89 51.4	41.6	40 24.2	08.4	353 29.0	24.2	158 39.3	23.8
16	10 31.8	104 50.9	41.9	55 24.7	07.8	8 31.0	24.0	173 41.7	23.8
17	25 34.3	119 50.4	42.1	70 25.2	07.3	23 33.0	23.8	188 44.2	23.8
18	40 36.7	134 49.8	S20 42.3	85 25.7	S18 06.7	38 35.0	S 0 23.6	203 46.7	S 4 23.7
19	55 39.2	149 49.3	42.5	100 26.1	06.2	53 37.0	23.4	218 49.2	23.7
20	70 41.7	164 48.8	42.7	115 26.6	05.6	68 39.1	23.2	233 51.7	23.7
21	85 44.1	179 48.2	42.9	130 27.1	05.1	83 41.1	23.0	248 54.2	23.7
22	100 46.6	194 47.7	43.1	145 27.6	04.5	98 43.1	22.8	263 56.6	23.7
23	115 49.1	209 47.2	43.4	160 28.0	04.0	113 45.1	22.6	278 59.1	23.6
1 00	130 51.5	224 46.6	S20 43.6	175 28.5	S18 03.4	128 47.1	S 0 22.4	294 01.6	S 4 23.6
01	145 54.0	239 46.1	43.8	190 29.0	02.9	143 49.1	22.2	309 04.1	23.6
02	160 56.5	254 45.6	44.0	205 29.5	02.3	158 51.2	22.0	324 06.6	23.6
03	175 58.9	269 45.0	44.2	220 30.0	01.7	173 53.2	21.8	339 09.1	23.6
04	191 01.4	284 44.5	44.4	235 30.4	01.2	188 55.2	21.6	354 11.5	23.5
05	206 03.8	299 43.9	44.6	250 30.9	00.6	203 57.2	21.4	9 14.0	23.5
06	221 06.3	314 43.4	S20 44.8	265 31.4	S18 00.1	218 59.2	S 0 21.2	24 16.5	S 4 23.5
07	236 08.8	329 42.9	45.0	280 31.9	17 59.5	234 01.2	21.0	39 19.0	23.5
T 08	251 11.2	344 42.3	45.2	295 32.3	59.0	249 03.2	20.8	54 21.5	23.5
U 09	266 13.7	359 41.8	45.4	310 32.8	58.4	264 05.3	20.6	69 24.0	23.4
E 10	281 16.2	14 41.3	45.6	325 33.3	57.8	279 07.3	20.4	84 26.5	23.4
S 11	296 18.6	29 40.7	45.8	340 33.8	57.3	294 09.3	20.2	99 28.9	23.4
D 12	311 21.1	44 40.2	S20 46.0	355 34.3	S17 56.7	309 11.3	S 0 20.0	114 31.4	S 4 23.4
A 13	326 23.6	59 39.6	46.2	10 34.7	56.2	324 13.3	19.8	129 33.9	23.3
Y 14	341 26.0	74 39.1	46.4	25 35.2	55.6	339 15.3	19.6	144 36.4	23.3
15	356 28.5	89 38.6	46.6	40 35.7	55.0	354 17.3	19.4	159 38.9	23.3
16	11 31.0	104 38.0	46.8	55 36.2	54.5	9 19.4	19.2	174 41.4	23.3
17	26 33.4	119 37.5	47.0	70 36.7	53.9	24 21.4	19.0	189 43.9	23.3
18	41 35.9	134 36.9	S20 47.2	85 37.1	S17 53.4	39 23.4	S 0 18.8	204 46.3	S 4 23.2
19	56 38.3	149 36.4	47.4	100 37.6	52.8	54 25.4	18.6	219 48.8	23.2
20	71 40.8	164 35.8	47.6	115 38.1	52.2	69 27.4	18.4	234 51.3	23.2
21	86 43.3	179 35.3	47.8	130 38.6	51.7	84 29.4	18.2	249 53.8	23.2
22	101 45.7	194 34.8	48.0	145 39.1	51.1	99 31.4	18.0	264 56.3	23.2
23	116 48.2	209 34.2	48.2	160 39.5	50.6	114 33.5	17.8	279 58.8	23.1
2 00	131 50.7	224 33.7	S20 48.4	175 40.0	S17 50.0	129 35.5	S 0 17.6	295 01.3	S 4 23.1
01	146 53.1	239 33.1	48.6	190 40.5	49.4	144 37.5	17.4	310 03.8	23.1
02	161 55.6	254 32.6	48.7	205 41.0	48.9	159 39.5	17.2	325 06.2	23.1
03	176 58.1	269 32.0	48.9	220 41.5	48.3	174 41.5	17.0	340 08.7	23.0
04	192 00.5	284 31.5	49.1	235 42.0	47.7	189 43.5	16.8	355 11.2	23.0
05	207 03.0	299 30.9	49.3	250 42.4	47.2	204 45.5	16.6	10 13.7	23.0
06	222 05.5	314 30.4	S20 49.5	265 42.9	S17 46.6	219 47.5	S 0 16.4	25 16.2	S 4 23.0
W 07	237 07.9	329 29.8	49.7	280 43.4	46.0	234 49.5	16.2	40 18.7	22.9
E 08	252 10.4	344 29.3	49.9	295 43.9	45.5	249 51.6	16.0	55 21.2	22.9
D 09	267 12.8	359 28.7	50.0	310 44.4	44.9	264 53.6	15.8	70 23.7	22.9
N 10	282 15.3	14 28.2	50.2	325 44.9	44.3	279 55.6	15.6	85 26.1	22.9
E 11	297 17.8	29 27.6	50.4	340 45.3	43.8	294 57.6	15.4	100 28.6	22.9
S 12	312 20.2	44 27.1	S20 50.6	355 45.8	S17 43.2	309 59.6	S 0 15.2	115 31.1	S 4 22.8
D 13	327 22.7	59 26.5	50.8	10 46.3	42.6	325 01.6	15.0	130 33.6	22.8
A 14	342 25.2	74 26.0	50.9	25 46.8	42.1	340 03.6	14.8	145 36.1	22.8
Y 15	357 27.6	89 25.4	51.1	40 47.3	41.5	355 05.6	14.5	160 38.6	22.8
16	12 30.1	104 24.9	51.3	55 47.8	40.9	10 07.6	14.3	175 41.1	22.7
17	27 32.6	119 24.3	51.5	70 48.2	40.4	25 09.7	14.1	190 43.6	22.7
18	42 35.0	134 23.8	S20 51.6	85 48.7	S17 39.8	40 11.7	S 0 13.9	205 46.1	S 4 22.7
19	57 37.5	149 23.2	51.8	100 49.2	39.2	55 13.7	13.7	220 48.6	22.7
20	72 39.9	164 22.7	52.0	115 49.7	38.7	70 15.7	13.5	235 51.1	22.7
21	87 42.4	179 22.1	52.2	130 50.2	38.1	85 17.7	13.3	250 53.5	22.6
22	102 44.9	194 21.6	52.3	145 50.7	37.5	100 19.7	13.1	265 56.0	22.6
23	117 47.3	209 21.0	52.5	160 51.2	37.0	115 21.7	12.9	280 58.5	22.6
	h m								
Mer. Pass.	15 14.1	v −0.5	d 0.2	v 0.5	d 0.6	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.5	S40 15.8
Achernar	335 28.1	S57 11.1
Acrux	173 10.9	S63 09.5
Adhara	255 13.5	S28 59.4
Aldebaran	290 51.1	N16 31.9
Alioth	166 21.8	N55 53.6
Alkaid	153 00.0	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.5	N26 40.4
Alpheratz	357 45.5	N29 09.3
Altair	62 10.2	N 8 53.9
Ankaa	353 17.5	S42 14.9
Antares	112 28.5	S26 27.3
Arcturus	145 57.2	N19 07.2
Atria	107 32.2	S69 02.6
Avior	234 18.1	S59 32.9
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.4	S52 42.3
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.2
Denebola	182 35.1	N14 30.3
Diphda	348 57.7	S17 55.6
Dubhe	193 53.0	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.3	N51 29.0
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.9
Gacrux	172 02.6	S57 10.4
Gienah	175 53.8	S17 36.3
Hadar	148 50.3	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.4	S34 22.7
Kochab	137 19.8	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.8	N 4 08.0
Menkent	148 09.5	S36 25.4
Miaplacidus	221 39.2	S69 45.9
Mirfak	308 42.7	N49 54.3
Nunki	76 00.7	S26 16.9
Peacock	53 22.4	S56 41.9
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.2	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.4	S 8 11.5
Rigil Kent.	139 54.1	S60 52.6
Sabik	102 14.7	S15 44.3
Schedar	349 42.8	N56 36.2
Shaula	96 24.5	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 32.9	S11 13.3
Suhail	222 53.3	S43 28.8
Vega	80 40.5	N38 47.5
Zuben'ubi	137 07.3	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	93 55.1	9 01
Mars	44 37.0	12 18
Jupiter	357 55.6	15 23
Saturn	163 10.1	4 23

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
31 00	176 40.4	S17 32.3	214 08.2	9.1	S23 04.0	4.2	56.1
01	191 40.3	31.6	228 36.3	9.2	22 59.8	4.3	56.1
02	206 40.2	30.9	243 04.5	9.2	22 55.5	4.4	56.1
03	221 40.1	. . 30.2	257 32.7	9.3	22 51.1	4.6	56.0
04	236 40.0	29.5	272 01.0	9.3	22 46.5	4.7	56.0
05	251 39.9	28.8	286 29.3	9.4	22 41.8	4.8	56.0
06	266 39.8	S17 28.1	300 57.7	9.5	S22 37.0	4.9	56.0
07	281 39.7	27.4	315 26.2	9.6	22 32.1	5.0	56.0
08	296 39.6	26.7	329 54.8	9.6	22 27.1	5.1	55.9
M 09	311 39.5	. . 26.0	344 23.4	9.6	22 22.0	5.3	55.9
O 10	326 39.4	25.3	358 52.0	9.8	22 16.7	5.3	55.9
N 11	341 39.3	24.6	13 20.8	9.7	22 11.4	5.5	55.9
D 12	356 39.2	S17 23.9	27 49.5	9.9	S22 05.9	5.6	55.9
A 13	11 39.1	23.2	42 18.4	9.9	22 00.3	5.7	55.8
Y 14	26 39.1	22.5	56 47.3	10.0	21 54.6	5.8	55.8
15	41 39.0	. . 21.8	71 16.3	10.1	21 48.8	5.9	55.8
16	56 38.9	21.1	85 45.4	10.1	21 42.9	6.0	55.8
17	71 38.8	20.4	100 14.5	10.2	21 36.9	6.2	55.8
18	86 38.7	S17 19.7	114 43.7	10.2	S21 30.7	6.2	55.7
19	101 38.6	19.0	129 12.9	10.4	21 24.5	6.3	55.7
20	116 38.5	18.3	143 42.3	10.4	21 18.2	6.5	55.7
21	131 38.4	. . 17.6	158 11.7	10.4	21 11.7	6.5	55.7
22	146 38.3	16.9	172 41.1	10.6	21 05.2	6.7	55.7
23	161 38.2	16.2	187 10.7	10.6	20 58.5	6.7	55.7
1 00	176 38.1	S17 15.5	201 40.3	10.6	S20 51.8	6.9	55.6
01	191 38.0	14.8	216 09.9	10.8	20 44.9	6.9	55.6
02	206 38.0	14.1	230 39.7	10.8	20 38.0	7.1	55.6
03	221 37.9	. . 13.4	245 09.5	10.9	20 30.9	7.1	55.6
04	236 37.8	12.7	259 39.4	10.9	20 23.8	7.2	55.6
05	251 37.7	12.0	274 09.3	11.0	20 16.6	7.4	55.5
06	266 37.6	S17 11.3	288 39.3	11.1	S20 09.2	7.4	55.5
07	281 37.5	10.6	303 09.4	11.2	20 01.8	7.5	55.5
T 08	296 37.4	09.9	317 39.6	11.2	19 54.3	7.6	55.5
U 09	311 37.3	. . 09.2	332 09.8	11.3	19 46.7	7.7	55.5
E 10	326 37.3	08.5	346 40.1	11.4	19 39.0	7.8	55.5
S 11	341 37.2	07.8	1 10.5	11.4	19 31.2	7.9	55.4
D 12	356 37.1	S17 07.0	15 40.9	11.5	S19 23.3	8.0	55.4
A 13	11 37.0	06.3	30 11.4	11.6	19 15.3	8.0	55.4
Y 14	26 36.9	05.6	44 42.0	11.7	19 07.3	8.2	55.4
15	41 36.8	. . 04.9	59 12.7	11.7	18 59.1	8.2	55.4
16	56 36.7	04.2	73 43.4	11.8	18 50.9	8.3	55.3
17	71 36.7	03.5	88 14.2	11.9	18 42.6	8.4	55.3
18	86 36.6	S17 02.8	102 45.1	11.9	S18 34.2	8.5	55.3
19	101 36.5	02.1	117 16.0	12.0	18 25.7	8.6	55.3
20	116 36.4	01.3	131 47.0	12.1	18 17.1	8.6	55.3
21	131 36.3	17 00.6	146 18.1	12.2	18 08.5	8.7	55.3
22	146 36.2	16 59.9	160 49.3	12.2	17 59.8	8.8	55.2
23	161 36.2	59.2	175 20.5	12.3	17 51.0	8.9	55.2
2 00	176 36.1	S16 58.5	189 51.8	12.3	S17 42.1	9.0	55.2
01	191 36.0	57.8	204 23.1	12.5	17 33.1	9.0	55.2
02	206 35.9	57.0	218 54.6	12.5	17 24.1	9.1	55.2
03	221 35.8	. . 56.3	233 26.1	12.5	17 15.0	9.2	55.2
04	236 35.8	55.6	247 57.6	12.7	17 05.8	9.2	55.1
05	251 35.7	54.9	262 29.3	12.7	16 56.6	9.3	55.1
06	266 35.6	S16 54.2	277 01.0	12.7	S16 47.3	9.4	55.1
W 07	281 35.5	53.4	291 32.7	12.9	16 37.9	9.5	55.1
E 08	296 35.4	52.7	306 04.6	12.9	16 28.4	9.5	55.1
D 09	311 35.4	. . 52.0	320 36.5	12.9	16 18.9	9.6	55.1
N 10	326 35.3	51.3	335 08.4	13.1	16 09.3	9.6	55.0
E 11	341 35.2	50.6	349 40.5	13.1	15 59.7	9.8	55.0
S 12	356 35.1	S16 49.8	4 12.6	13.1	S15 49.9	9.8	55.0
D 13	11 35.1	49.1	18 44.7	13.3	15 40.1	9.8	55.0
A 14	26 35.0	48.4	33 17.0	13.3	15 30.3	9.9	55.0
Y 15	41 34.9	. . 47.7	47 49.3	13.3	15 20.4	10.0	55.0
16	56 34.8	46.9	62 21.6	13.5	15 10.4	10.0	54.9
17	71 34.7	46.2	76 54.1	13.5	15 00.4	10.1	54.9
18	86 34.7	S16 45.5	91 26.6	13.5	S14 50.3	10.2	54.9
19	101 34.6	44.8	105 59.1	13.6	14 40.1	10.2	54.9
20	116 34.5	44.0	120 31.7	13.7	14 29.9	10.3	54.9
21	131 34.5	. . 43.3	135 04.4	13.8	14 19.6	10.3	54.9
22	146 34.4	42.6	149 37.2	13.8	14 09.3	10.4	54.9
23	161 34.3	41.8	164 10.0	13.8	S13 58.9	10.4	54.8
	SD 16.3	d 0.7	SD	15.2		15.1	15.0

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 31	Moonrise 1	Moonrise 2	Moonrise 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 11	08 40	10 30	▬	▬	09 55	09 10
N 70	07 03	08 21	09 47	▬	10 14	09 13	08 49
68	06 56	08 06	09 19	▬	09 05	08 45	08 32
66	06 50	07 54	08 57	08 36	08 29	08 23	08 19
64	06 45	07 44	08 40	07 54	08 03	08 06	08 08
62	06 41	07 35	08 27	07 25	07 42	07 52	07 58
60	06 37	07 27	08 15	07 03	07 25	07 40	07 50
N 58	06 33	07 20	08 04	06 46	07 11	07 29	07 42
56	06 29	07 14	07 56	06 31	06 59	07 20	07 36
54	06 26	07 09	07 48	06 18	06 49	07 12	07 30
52	06 23	07 04	07 41	06 06	06 39	07 05	07 25
50	06 20	06 59	07 34	05 56	06 31	06 58	07 20
45	06 14	06 49	07 20	05 35	06 12	06 44	07 10
N 40	06 08	06 40	07 09	05 17	05 58	06 32	07 01
35	06 02	06 33	06 59	05 03	05 45	06 22	06 54
30	05 57	06 25	06 51	04 50	05 34	06 13	06 47
20	05 46	06 13	06 36	04 29	05 15	05 58	06 36
N 10	05 35	06 01	06 22	04 10	04 59	05 44	06 26
0	05 23	05 48	06 10	03 52	04 43	05 31	06 17
S 10	05 09	05 35	05 57	03 35	04 28	05 19	06 07
20	04 53	05 21	05 44	03 16	04 11	05 05	05 57
30	04 32	05 02	05 28	02 54	03 52	04 50	05 46
35	04 18	04 51	05 19	02 41	03 41	04 41	05 39
40	04 02	04 39	05 09	02 26	03 28	04 30	05 32
45	03 41	04 23	04 56	02 09	03 13	04 18	05 23
S 50	03 13	04 03	04 41	01 47	02 54	04 03	05 12
52	02 59	03 53	04 34	01 37	02 45	03 56	05 07
54	02 42	03 42	04 26	01 25	02 35	03 48	05 01
56	02 21	03 30	04 17	01 11	02 24	03 39	04 55
58	01 53	03 15	04 07	00 56	02 11	03 30	04 48
S 60	01 07	02 57	03 55	00 37	01 56	03 18	04 40

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 31	Moonset 1	Moonset 2	Moonset 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	13 58	15 49	17 18	▬	▬	13 49	16 07
N 70	14 41	16 07	17 26	▬	11 49	14 29	16 26
68	15 09	16 22	17 32	▬	12 57	14 56	16 41
66	15 31	16 34	17 38	11 41	13 33	15 16	16 53
64	15 48	16 44	17 43	12 23	13 58	15 33	17 03
62	16 01	16 53	17 47	12 51	14 18	15 46	17 12
60	16 13	17 01	17 51	13 12	14 34	15 57	17 19
N 58	16 23	17 07	17 55	13 30	14 48	16 07	17 25
56	16 32	17 13	17 58	13 45	15 00	16 16	17 31
54	16 40	17 19	18 02	13 57	15 10	16 23	17 36
52	16 47	17 24	18 05	14 08	15 19	16 30	17 40
50	16 54	17 28	18 07	14 18	15 27	16 36	17 44
45	17 07	17 39	18 14	14 39	15 44	16 49	17 53
N 40	17 19	17 47	18 20	14 56	15 58	17 00	18 01
35	17 28	17 55	18 25	15 10	16 10	17 09	18 07
30	17 37	18 02	18 31	15 22	16 20	17 17	18 12
20	17 52	18 15	18 41	15 42	16 37	17 31	18 22
N 10	18 05	18 27	18 52	16 00	16 53	17 43	18 30
0	18 17	18 39	19 04	16 17	17 07	17 54	18 38
S 10	18 30	18 52	19 17	16 34	17 21	18 05	18 45
20	18 43	19 06	19 34	16 51	17 36	18 16	18 53
30	18 58	19 24	19 55	17 12	17 53	18 30	19 03
35	19 07	19 35	20 08	17 24	18 03	18 37	19 08
40	19 18	19 48	20 24	17 37	18 14	18 46	19 14
45	19 30	20 03	20 45	17 53	18 27	18 56	19 21
S 50	19 45	20 23	21 12	18 13	18 43	19 08	19 29
52	19 52	20 32	21 26	18 22	18 51	19 14	19 33
54	20 00	20 43	21 43	18 32	18 59	19 20	19 37
56	20 09	20 55	22 03	18 44	19 09	19 27	19 41
58	20 19	21 10	22 30	18 57	19 19	19 35	19 46
S 60	20 30	21 27	23 12	19 13	19 31	19 43	19 52

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
31	13 18	13 23	12 13	10 05	22 30	27	7
1	13 27	13 31	12 14	10 55	23 19	28	3
2	13 36	13 39	12 14	11 43	24 05	29	0

UT	ARIES	VENUS −4.3		MARS +1.1		JUPITER −2.2		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
3 00	132 49.8	224 20.4	S20 52.7	175 51.6	S17 36.4	130 23.7	S 0 12.7	296 01.0	S 4 22.6
01	147 52.3	239 19.9	52.8	190 52.1	35.8	145 25.7	12.5	311 03.5	22.5
02	162 54.7	254 19.3	53.0	205 52.6	35.2	160 27.7	12.3	326 06.0	22.5
03	177 57.2	269 18.8 . .	53.2	220 53.1 . .	34.7	175 29.7 . .	12.1	341 08.5 . .	22.5
04	192 59.7	284 18.2	53.3	235 53.6	34.1	190 31.8	11.9	356 11.0	22.5
05	208 02.1	299 17.7	53.5	250 54.1	33.5	205 33.8	11.7	11 13.5	22.4
06	223 04.6	314 17.1	S20 53.7	265 54.6	S17 33.0	220 35.8	S 0 11.5	26 16.0	S 4 22.4
07	238 07.1	329 16.5	53.8	280 55.0	32.4	235 37.8	11.3	41 18.5	22.4
T 08	253 09.5	344 16.0	54.0	295 55.5	31.8	250 39.8	11.1	56 21.0	22.4
H 09	268 12.0	359 15.4 . .	54.2	310 56.0 . .	31.2	265 41.8 . .	10.9	71 23.5 . .	22.3
U 10	283 14.4	14 14.9	54.3	325 56.5	30.7	280 43.8	10.7	86 25.9	22.3
R 11	298 16.9	29 14.3	54.5	340 57.0	30.1	295 45.8	10.5	101 28.4	22.3
S 12	313 19.4	44 13.7	S20 54.6	355 57.5	S17 29.5	310 47.8	S 0 10.3	116 30.9	S 4 22.3
D 13	328 21.8	59 13.2	54.8	10 58.0	28.9	325 49.8	10.1	131 33.4	22.2
A 14	343 24.3	74 12.6	54.9	25 58.5	28.4	340 51.8	09.9	146 35.9	22.2
Y 15	358 26.8	89 12.1 . .	55.1	40 58.9 . .	27.8	355 53.8 . .	09.6	161 38.4 . .	22.2
16	13 29.2	104 11.5	55.3	55 59.4	27.2	10 55.8	09.4	176 40.9	22.2
17	28 31.7	119 10.9	55.4	70 59.9	26.6	25 57.9	09.2	191 43.4	22.1
18	43 34.2	134 10.4	S20 55.6	86 00.4	S17 26.1	40 59.9	S 0 09.0	206 45.9	S 4 22.1
19	58 36.6	149 09.8	55.7	101 00.9	25.5	56 01.9	08.8	221 48.4	22.1
20	73 39.1	164 09.2	55.9	116 01.4	24.9	71 03.9	08.6	236 50.9	22.1
21	88 41.6	179 08.7 . .	56.0	131 01.9 . .	24.3	86 05.9 . .	08.4	251 53.4 . .	22.0
22	103 44.0	194 08.1	56.2	146 02.4	23.7	101 07.9	08.2	266 55.9	22.0
23	118 46.5	209 07.5	56.3	161 02.9	23.2	116 09.9	08.0	281 58.4	22.0
4 00	133 48.9	224 07.0	S20 56.5	176 03.4	S17 22.6	131 11.9	S 0 07.8	297 00.9	S 4 22.0
01	148 51.4	239 06.4	56.6	191 03.8	22.0	146 13.9	07.6	312 03.4	21.9
02	163 53.9	254 05.8	56.8	206 04.3	21.4	161 15.9	07.4	327 05.9	21.9
03	178 56.3	269 05.3 . .	56.9	221 04.8 . .	20.9	176 17.9 . .	07.2	342 08.4 . .	21.9
04	193 58.8	284 04.7	57.1	236 05.3	20.3	191 19.9	07.0	357 10.9	21.9
05	209 01.3	299 04.1	57.2	251 05.8	19.7	206 21.9	06.8	12 13.4	21.8
06	224 03.7	314 03.6	S20 57.3	266 06.3	S17 19.1	221 23.9	S 0 06.6	27 15.8	S 4 21.8
07	239 06.2	329 03.0	57.5	281 06.8	18.5	236 25.9	06.4	42 18.3	21.8
08	254 08.7	344 02.4	57.6	296 07.3	18.0	251 27.9	06.2	57 20.8	21.8
F 09	269 11.1	359 01.9 . .	57.8	311 07.8 . .	17.4	266 29.9 . .	06.0	72 23.3 . .	21.7
R 10	284 13.6	14 01.3	57.9	326 08.3	16.8	281 31.9	05.7	87 25.8	21.7
I 11	299 16.0	29 00.7	58.0	341 08.8	16.2	296 33.9	05.5	102 28.3	21.7
D 12	314 18.5	44 00.2	S20 58.2	356 09.3	S17 15.6	311 35.9	S 0 05.3	117 30.8	S 4 21.7
A 13	329 21.0	58 59.6	58.3	11 09.7	15.0	326 38.0	05.1	132 33.3	21.6
Y 14	344 23.4	73 59.0	58.4	26 10.2	14.5	341 40.0	04.9	147 35.8	21.6
15	359 25.9	88 58.4 . .	58.6	41 10.7 . .	13.9	356 42.0 . .	04.7	162 38.3 . .	21.6
16	14 28.4	103 57.9	58.7	56 11.2	13.3	11 44.0	04.5	177 40.8	21.6
17	29 30.8	118 57.3	58.9	71 11.7	12.7	26 46.0	04.3	192 43.3	21.5
18	44 33.3	133 56.7	S20 59.0	86 12.2	S17 12.1	41 48.0	S 0 04.1	207 45.8	S 4 21.5
19	59 35.8	148 56.2	59.1	101 12.7	11.5	56 50.0	03.9	222 48.3	21.5
20	74 38.2	163 55.6	59.2	116 13.2	11.0	71 52.0	03.7	237 50.8	21.4
21	89 40.7	178 55.0 . .	59.4	131 13.7 . .	10.4	86 54.0 . .	03.5	252 53.3 . .	21.4
22	104 43.2	193 54.4	59.5	146 14.2	09.8	101 56.0	03.3	267 55.8	21.4
23	119 45.6	208 53.9	59.6	161 14.7	09.2	116 58.0	03.1	282 58.3	21.4
5 00	134 48.1	223 53.3	S20 59.8	176 15.2	S17 08.6	132 00.0	S 0 02.9	298 00.8	S 4 21.3
01	149 50.5	238 52.7	20 59.9	191 15.7	08.0	147 02.0	02.6	313 03.3	21.3
02	164 53.0	253 52.1	21 00.0	206 16.2	07.4	162 04.0	02.4	328 05.8	21.3
03	179 55.5	268 51.6 . .	00.1	221 16.7 . .	06.9	177 06.0 . .	02.2	343 08.3 . .	21.3
04	194 57.9	283 51.0	00.3	236 17.2	06.3	192 08.0	02.0	358 10.8	21.2
05	210 00.4	298 50.4	00.4	251 17.7	05.7	207 10.0	01.8	13 13.3	21.2
06	225 02.9	313 49.8	S21 00.5	266 18.2	S17 05.1	222 12.0	S 0 01.6	28 15.8	S 4 21.2
07	240 05.3	328 49.3	00.6	281 18.6	04.5	237 14.0	01.4	43 18.3	21.1
S 08	255 07.8	343 48.7	00.7	296 19.1	03.9	252 16.0	01.2	58 20.8	21.1
A 09	270 10.3	358 48.1 . .	00.9	311 19.6 . .	03.3	267 18.0 . .	01.0	73 23.3 . .	21.1
T 10	285 12.7	13 47.5	01.0	326 20.1	02.7	282 20.0	00.8	88 25.8	21.1
U 11	300 15.2	28 46.9	01.1	341 20.6	02.1	297 22.0	00.6	103 28.3	21.0
R 12	315 17.6	43 46.4	S21 01.2	356 21.1	S17 01.6	312 24.0	S 0 00.4	118 30.8	S 4 21.0
D 13	330 20.1	58 45.8	01.3	11 21.6	01.0	327 26.0	S 00.2	133 33.3	21.0
A 14	345 22.6	73 45.2	01.4	26 22.1	17 00.4	342 28.0	00.0	148 35.8	21.0
Y 15	0 25.0	88 44.6 . .	01.5	41 22.6	16 59.8	357 30.0	N 00.2	163 38.3 . .	20.9
16	15 27.5	103 44.0	01.7	56 23.1	59.2	12 32.0	00.5	178 40.8	20.9
17	30 30.0	118 43.5	01.8	71 23.6	58.6	27 34.0	00.7	193 43.3	20.9
18	45 32.4	133 42.9	S21 01.9	86 24.1	S16 58.0	42 36.0	N 0 00.9	208 45.8	S 4 20.8
19	60 34.9	148 42.3	02.0	101 24.6	57.4	57 38.0	01.1	223 48.4	20.8
20	75 37.4	163 41.7	02.1	116 25.1	56.8	72 40.0	01.3	238 50.9	20.8
21	90 39.8	178 41.1 . .	02.2	131 25.6 . .	56.2	87 42.0 . .	01.5	253 53.4 . .	20.8
22	105 42.3	193 40.5	02.3	146 26.1	55.6	102 44.0	01.7	268 55.9	20.7
23	120 44.8	208 40.0	02.4	161 26.6	55.0	117 46.0	01.9	283 58.4	20.7
	h m								
Mer. Pass.	15 02.3	v −0.6	d 0.1	v 0.5	d 0.6	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.5	S40 15.8
Achernar	335 28.1	S57 11.0
Acrux	173 10.9	S63 09.6
Adhara	255 13.5	S28 59.5
Aldebaran	290 51.1	N16 31.9
Alioth	166 21.7	N55 53.6
Alkaid	153 00.0	N49 15.1
Al Na'ir	27 46.2	S46 54.5
Alnilam	275 47.8	S 1 11.8
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.5	N26 40.4
Alpheratz	357 45.5	N29 09.3
Altair	62 10.2	N 8 53.8
Ankaa	353 17.5	S42 14.9
Antares	112 28.5	S26 27.4
Arcturus	145 57.2	N19 07.2
Atria	107 32.1	S69 02.6
Avior	234 18.1	S59 32.9
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.5	S52 42.3
Capella	280 36.6	N46 00.6
Deneb	49 33.1	N45 19.2
Denebola	182 35.1	N14 30.3
Diphda	348 57.7	S17 55.6
Dubhe	193 53.0	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.3	N51 29.0
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.5	S57 10.5
Gienah	175 53.8	S17 36.3
Hadar	148 50.2	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.3	S34 22.7
Kochab	137 19.8	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.8	N 4 08.0
Menkent	148 09.5	S36 25.4
Miaplacidus	221 39.2	S69 45.9
Mirfak	308 42.7	N49 54.3
Nunki	76 00.7	S26 16.9
Peacock	53 22.4	S56 41.9
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.2	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.5	S 8 11.5
Rigil Kent.	139 54.0	S60 52.7
Sabik	102 14.7	S15 44.3
Schedar	349 42.9	N56 36.2
Shaula	96 24.5	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 32.9	S11 13.3
Suhail	222 53.3	S43 28.8
Vega	80 40.4	N38 47.5
Zuben'ubi	137 07.3	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	90 18.0	9 04
Mars	42 14.4	12 15
Jupiter	357 23.0	15 13
Saturn	163 11.9	4 11

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
3 00	176 34.2	S16 41.1	178 42.8	13.9	S13 48.5	10.5	54.8
01	191 34.2	40.4	193 15.7	14.0	13 38.0	10.6	54.8
02	206 34.1	39.7	207 48.7	14.1	13 27.4	10.5	54.8
03	221 34.0	. . 38.9	222 21.8	14.1	13 16.9	10.7	54.8
04	236 33.9	38.2	236 54.9	14.1	13 06.2	10.7	54.8
05	251 33.9	37.5	251 28.0	14.2	12 55.5	10.7	54.8
06	266 33.8	S16 36.7	266 01.2	14.3	S12 44.8	10.8	54.7
07	281 33.7	36.0	280 34.5	14.3	12 34.0	10.8	54.7
T 08	296 33.7	35.3	295 07.8	14.4	12 23.2	10.9	54.7
H 09	311 33.6	. . 34.5	309 41.2	14.5	12 12.3	10.9	54.7
U 10	326 33.5	33.8	324 14.7	14.5	12 01.4	11.0	54.7
R 11	341 33.4	33.1	338 48.2	14.5	11 50.4	11.0	54.7
S 12	356 33.4	S16 32.3	353 21.7	14.6	S11 39.4	11.1	54.7
D 13	11 33.3	31.6	7 55.3	14.6	11 28.3	11.1	54.6
A 14	26 33.2	30.9	22 28.9	14.7	11 17.2	11.1	54.6
Y 15	41 33.2	. . 30.1	37 02.6	14.8	11 06.1	11.2	54.6
16	56 33.1	29.4	51 36.4	14.8	10 54.9	11.2	54.6
17	71 33.0	28.7	66 10.2	14.9	10 43.7	11.2	54.6
18	86 33.0	S16 27.9	80 44.1	14.9	S10 32.5	11.3	54.6
19	101 32.9	27.2	95 18.0	14.9	10 21.2	11.3	54.6
20	116 32.8	26.4	109 51.9	15.0	10 09.9	11.4	54.5
21	131 32.8	. . 25.7	124 25.9	15.1	9 58.5	11.4	54.5
22	146 32.7	25.0	139 00.0	15.0	9 47.1	11.4	54.5
23	161 32.6	24.2	153 34.0	15.2	9 35.7	11.5	54.5
4 00	176 32.6	S16 23.5	168 08.2	15.2	S 9 24.2	11.5	54.5
01	191 32.5	22.7	182 42.4	15.2	9 12.7	11.5	54.5
02	206 32.5	22.0	197 16.6	15.3	9 01.2	11.5	54.5
03	221 32.4	. . 21.2	211 50.9	15.3	8 49.7	11.6	54.5
04	236 32.3	20.5	226 25.2	15.3	8 38.1	11.6	54.4
05	251 32.3	19.8	240 59.5	15.4	8 26.5	11.7	54.4
06	266 32.2	S16 19.0	255 33.9	15.5	S 8 14.8	11.6	54.4
07	281 32.1	18.3	270 08.4	15.4	8 03.2	11.7	54.4
08	296 32.1	17.5	284 42.8	15.5	7 51.5	11.7	54.4
F 09	311 32.0	. . 16.8	299 17.3	15.6	7 39.8	11.8	54.4
R 10	326 32.0	16.0	313 51.9	15.6	7 28.0	11.7	54.4
I 11	341 31.9	15.3	328 26.5	15.6	7 16.3	11.8	54.4
D 12	356 31.8	S16 14.5	343 01.1	15.7	S 7 04.5	11.8	54.4
A 13	11 31.8	13.8	357 35.8	15.7	6 52.7	11.9	54.3
Y 14	26 31.7	13.0	12 10.5	15.7	6 40.8	11.8	54.3
15	41 31.7	. . 12.3	26 45.2	15.8	6 29.0	11.9	54.3
16	56 31.6	11.6	41 20.0	15.8	6 17.1	11.9	54.3
17	71 31.5	10.8	55 54.8	15.8	6 05.2	11.9	54.3
18	86 31.5	S16 10.1	70 29.6	15.8	S 5 53.3	11.9	54.3
19	101 31.4	09.3	85 04.4	15.9	5 41.4	11.9	54.3
20	116 31.4	08.6	99 39.3	16.0	5 29.5	12.0	54.3
21	131 31.3	. . 07.8	114 14.3	15.9	5 17.5	12.0	54.3
22	146 31.2	07.0	128 49.2	16.0	5 05.5	11.9	54.3
23	161 31.2	06.3	143 24.2	16.0	4 53.6	12.0	54.3
5 00	176 31.1	S16 05.5	157 59.2	16.0	S 4 41.6	12.0	54.2
01	191 31.1	04.8	172 34.2	16.1	4 29.6	12.1	54.2
02	206 31.0	04.0	187 09.3	16.1	4 17.5	12.0	54.2
03	221 31.0	. . 03.3	201 44.4	16.1	4 05.5	12.1	54.2
04	236 30.9	02.5	216 19.5	16.1	3 53.4	12.0	54.2
05	251 30.9	01.8	230 54.6	16.1	3 41.4	12.1	54.2
06	266 30.8	S16 01.0	245 29.7	16.2	S 3 29.3	12.0	54.2
07	281 30.8	16 00.3	260 04.9	16.2	3 17.3	12.1	54.2
S 08	296 30.7	15 59.5	274 40.1	16.2	3 05.2	12.1	54.2
A 09	311 30.6	. . 58.7	289 15.3	16.2	2 53.1	12.1	54.2
T 10	326 30.6	58.0	303 50.5	16.3	2 41.0	12.1	54.2
U 11	341 30.5	57.2	318 25.8	16.3	2 28.9	12.1	54.2
R 12	356 30.5	S15 56.5	333 01.1	16.2	S 2 16.8	12.1	54.1
D 13	11 30.4	55.7	347 36.3	16.3	2 04.7	12.1	54.1
A 14	26 30.4	55.0	2 11.6	16.4	1 52.6	12.1	54.1
Y 15	41 30.3	. . 54.2	16 47.0	16.3	1 40.5	12.2	54.1
16	56 30.3	53.4	31 22.3	16.3	1 28.3	12.1	54.1
17	71 30.2	52.7	45 57.6	16.4	1 16.2	12.1	54.1
18	86 30.2	S15 51.9	60 33.0	16.3	S 1 04.1	12.1	54.1
19	101 30.1	51.2	75 08.3	16.4	0 52.0	12.1	54.1
20	116 30.1	50.4	89 43.7	16.4	0 39.9	12.2	54.1
21	131 30.0	. . 49.6	104 19.1	16.4	0 27.7	12.1	54.1
22	146 30.0	48.9	118 54.5	16.4	0 15.6	12.1	54.1
23	161 29.9	48.1	133 29.9	16.4	S 0 03.5	12.1	54.1
	SD 16.3	d 0.7	SD 14.9		14.8		14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 3	Moonrise 4	Moonrise 5	Moonrise 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 00	08 26	10 06	09 10	08 42	08 20	08 00
N 70	06 53	08 10	09 31	08 49	08 31	08 16	08 02
68	06 47	07 56	09 06	08 32	08 22	08 13	08 04
66	06 42	07 45	08 47	08 19	08 14	08 10	08 06
64	06 38	07 36	08 31	08 08	08 08	08 08	08 07
62	06 34	07 28	08 18	07 58	08 02	08 05	08 08
60	06 31	07 21	08 08	07 50	07 57	08 03	08 09
N 58	06 28	07 15	07 58	07 42	07 53	08 02	08 10
56	06 25	07 09	07 50	07 36	07 49	08 00	08 11
54	06 22	07 04	07 42	07 30	07 45	07 59	08 12
52	06 19	06 59	07 36	07 25	07 42	07 58	08 12
50	06 17	06 55	07 30	07 20	07 39	07 57	08 13
45	06 11	06 46	07 17	07 10	07 33	07 54	08 14
N 40	06 05	06 38	07 06	07 01	07 28	07 52	08 16
35	06 00	06 30	06 57	06 54	07 23	07 50	08 17
30	05 55	06 24	06 49	06 47	07 19	07 49	08 17
20	05 45	06 12	06 35	06 36	07 12	07 46	08 19
N 10	05 35	06 00	06 22	06 26	07 06	07 43	08 20
0	05 24	05 49	06 10	06 17	07 00	07 41	08 22
S 10	05 11	05 37	05 58	06 07	06 54	07 39	08 23
20	04 55	05 22	05 46	05 57	06 48	07 36	08 24
30	04 35	05 05	05 31	05 46	06 40	07 34	08 26
35	04 22	04 55	05 22	05 39	06 36	07 32	08 27
40	04 06	04 43	05 12	05 32	06 32	07 30	08 28
45	03 46	04 28	05 01	05 23	06 26	07 28	08 29
S 50	03 20	04 09	04 46	05 12	06 19	07 26	08 31
52	03 07	04 00	04 40	05 07	06 16	07 24	08 32
54	02 51	03 50	04 32	05 01	06 13	07 23	08 33
56	02 32	03 38	04 24	04 55	06 09	07 22	08 33
58	02 08	03 24	04 14	04 48	06 05	07 20	08 34
S 60	01 32	03 08	04 04	04 40	06 00	07 19	08 35

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 3	Moonset 4	Moonset 5	Moonset 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	14 23	16 03	17 30	16 07	18 03	19 51	21 38
N 70	14 58	16 19	17 36	16 26	18 12	19 52	21 31
68	15 23	16 33	17 42	16 41	18 19	19 53	21 26
66	15 42	16 44	17 47	16 53	18 25	19 54	21 22
64	15 57	16 53	17 51	17 03	18 30	19 55	21 18
62	16 10	17 01	17 55	17 12	18 34	19 55	21 15
60	16 21	17 08	17 58	17 19	18 38	19 56	21 12
N 58	16 31	17 14	18 01	17 25	18 41	19 56	21 10
56	16 39	17 19	18 04	17 31	18 44	19 56	21 08
54	16 46	17 24	18 07	17 36	18 47	19 57	21 06
52	16 53	17 29	18 09	17 40	18 49	19 57	21 04
50	16 59	17 33	18 12	17 44	18 51	19 57	21 02
45	17 12	17 43	18 18	17 53	18 56	19 58	20 59
N 40	17 22	17 51	18 23	18 01	19 00	19 58	20 56
35	17 31	17 58	18 28	18 07	19 03	19 59	20 54
30	17 39	18 04	18 33	18 12	19 06	19 59	20 51
20	17 53	18 16	18 43	18 22	19 11	20 00	20 48
N 10	18 06	18 28	18 53	18 30	19 16	20 00	20 44
0	18 17	18 39	19 04	18 38	19 20	20 01	20 41
S 10	18 29	18 51	19 17	18 45	19 24	20 01	20 38
20	18 42	19 05	19 32	18 53	19 28	20 02	20 35
30	18 56	19 22	19 53	19 03	19 33	20 02	20 31
35	19 05	19 32	20 05	19 08	19 36	20 03	20 29
40	19 15	19 44	20 21	19 14	19 39	20 03	20 26
45	19 26	19 59	20 40	19 21	19 43	20 03	20 24
S 50	19 40	20 18	21 06	19 29	19 47	20 04	20 20
52	19 47	20 27	21 19	19 33	19 49	20 04	20 19
54	19 54	20 37	21 34	19 37	19 51	20 04	20 17
56	20 02	20 48	21 52	19 41	19 53	20 04	20 15
58	20 12	21 02	22 16	19 46	19 56	20 05	20 13
S 60	20 22	21 18	22 50	19 52	19 59	20 05	20 11

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
3	13 43	13 46	12 14	12 27	00 05	00	0
4	13 50	13 53	12 14	13 10	00 49	01	2
5	13 55	13 58	12 14	13 51	01 31	02	5

UT	ARIES	VENUS −4.3		MARS +1.1		JUPITER −2.1		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
6 00	135 47.2	223 39.4	S21 02.5	176 27.1	S16 54.5	132 48.0	N 0 02.1	299 00.9	S 4 20.7
01	150 49.7	238 38.8	02.6	191 27.6	53.9	147 50.0	02.3	314 03.4	20.6
02	165 52.1	253 38.2	02.7	206 28.1	53.3	162 52.0	02.5	329 05.9	20.6
03	180 54.6	268 37.6	02.8	221 28.6	52.7	177 54.0	02.7	344 08.4	20.6
04	195 57.1	283 37.0	02.9	236 29.1	52.1	192 56.0	03.0	359 10.9	20.6
05	210 59.5	298 36.4	03.0	251 29.6	51.5	207 58.0	03.2	14 13.4	20.5
06	226 02.0	313 35.9	S21 03.1	266 30.1	S16 50.9	223 00.0	N 0 03.4	29 15.9	S 4 20.5
07	241 04.5	328 35.3	03.2	281 30.6	50.3	238 02.0	03.6	44 18.4	20.5
08	256 06.9	343 34.7	03.3	296 31.1	49.7	253 04.0	03.8	59 20.9	20.4
S 09	271 09.4	358 34.1	03.4	311 31.6	49.1	268 06.0	04.0	74 23.4	20.4
U 10	286 11.9	13 33.5	03.5	326 32.1	48.5	283 08.0	04.2	89 25.9	20.4
N 11	301 14.3	28 32.9	03.6	341 32.6	47.9	298 10.0	04.4	104 28.4	20.4
D 12	316 16.8	43 32.3	S21 03.7	356 33.1	S16 47.3	313 12.0	N 0 04.6	119 30.9	S 4 20.3
A 13	331 19.3	58 31.8	03.8	11 33.6	46.7	328 14.0	04.8	134 33.4	20.3
Y 14	346 21.7	73 31.2	03.9	26 34.1	46.1	343 16.0	05.0	149 35.9	20.3
15	1 24.2	88 30.6	04.0	41 34.6	45.5	358 18.0	05.2	164 38.5	20.2
16	16 26.6	103 30.0	04.1	56 35.1	44.9	13 20.0	05.5	179 41.0	20.2
17	31 29.1	118 29.4	04.2	71 35.6	44.3	28 22.0	05.7	194 43.5	20.2
18	46 31.6	133 28.8	S21 04.2	86 36.1	S16 43.7	43 24.0	N 0 05.9	209 46.0	S 4 20.1
19	61 34.0	148 28.2	04.3	101 36.6	43.1	58 26.0	06.1	224 48.5	20.1
20	76 36.5	163 27.6	04.4	116 37.1	42.5	73 27.9	06.3	239 51.0	20.1
21	91 39.0	178 27.0	04.5	131 37.6	41.9	88 29.9	06.5	254 53.5	20.1
22	106 41.4	193 26.4	04.6	146 38.1	41.3	103 31.9	06.7	269 56.0	20.0
23	121 43.9	208 25.8	04.7	161 38.6	40.7	118 33.9	06.9	284 58.5	20.0
7 00	136 46.4	223 25.3	S21 04.8	176 39.1	S16 40.1	133 35.9	N 0 07.1	300 01.0	S 4 20.0
01	151 48.8	238 24.7	04.8	191 39.6	39.5	148 37.9	07.3	315 03.5	19.9
02	166 51.3	253 24.1	04.9	206 40.2	38.9	163 39.9	07.5	330 06.0	19.9
03	181 53.7	268 23.5	05.0	221 40.7	38.3	178 41.9	07.8	345 08.5	19.9
04	196 56.2	283 22.9	05.1	236 41.2	37.7	193 43.9	08.0	0 11.1	19.8
05	211 58.7	298 22.3	05.2	251 41.7	37.1	208 45.9	08.2	15 13.6	19.8
06	227 01.1	313 21.7	S21 05.2	266 42.2	S16 36.5	223 47.9	N 0 08.4	30 16.1	S 4 19.8
07	242 03.6	328 21.1	05.3	281 42.7	35.9	238 49.9	08.6	45 18.6	19.8
08	257 06.1	343 20.5	05.4	296 43.2	35.3	253 51.9	08.8	60 21.1	19.7
M 09	272 08.5	358 19.9	05.5	311 43.7	34.7	268 53.9	09.0	75 23.6	19.7
O 10	287 11.0	13 19.3	05.5	326 44.2	34.1	283 55.9	09.2	90 26.1	19.7
N 11	302 13.5	28 18.7	05.6	341 44.7	33.5	298 57.9	09.4	105 28.6	19.6
D 12	317 15.9	43 18.1	S21 05.7	356 45.2	S16 32.9	313 59.9	N 0 09.6	120 31.1	S 4 19.6
A 13	332 18.4	58 17.5	05.7	11 45.7	32.3	329 01.9	09.8	135 33.6	19.6
Y 14	347 20.9	73 16.9	05.8	26 46.2	31.7	344 03.9	10.1	150 36.1	19.5
15	2 23.3	88 16.3	05.9	41 46.7	31.1	359 05.9	10.3	165 38.7	19.5
16	17 25.8	103 15.7	06.0	56 47.2	30.5	14 07.8	10.5	180 41.2	19.5
17	32 28.2	118 15.1	06.0	71 47.7	29.9	29 09.8	10.7	195 43.7	19.4
18	47 30.7	133 14.5	S21 06.1	86 48.2	S16 29.2	44 11.8	N 0 10.9	210 46.2	S 4 19.4
19	62 33.2	148 13.9	06.1	101 48.7	28.6	59 13.8	11.1	225 48.7	19.4
20	77 35.6	163 13.3	06.2	116 49.3	28.0	74 15.8	11.3	240 51.2	19.3
21	92 38.1	178 12.8	06.3	131 49.8	27.4	89 17.8	11.5	255 53.7	19.3
22	107 40.6	193 12.2	06.3	146 50.3	26.8	104 19.8	11.7	270 56.2	19.3
23	122 43.0	208 11.6	06.4	161 50.8	26.2	119 21.8	11.9	285 58.7	19.3
8 00	137 45.5	223 11.0	S21 06.5	176 51.3	S16 25.6	134 23.8	N 0 12.2	301 01.3	S 4 19.2
01	152 48.0	238 10.4	06.5	191 51.8	25.0	149 25.8	12.4	316 03.8	19.2
02	167 50.4	253 09.8	06.6	206 52.3	24.4	164 27.8	12.6	331 06.3	19.2
03	182 52.9	268 09.2	06.6	221 52.8	23.8	179 29.8	12.8	346 08.8	19.1
04	197 55.3	283 08.6	06.7	236 53.3	23.2	194 31.8	13.0	1 11.3	19.1
05	212 57.8	298 07.9	06.7	251 53.8	22.6	209 33.8	13.2	16 13.8	19.1
06	228 00.3	313 07.3	S21 06.8	266 54.3	S16 21.9	224 35.7	N 0 13.4	31 16.3	S 4 19.0
07	243 02.7	328 06.7	06.9	281 54.8	21.3	239 37.7	13.6	46 18.8	19.0
T 08	258 05.2	343 06.1	06.9	296 55.4	20.7	254 39.7	13.8	61 21.4	19.0
U 09	273 07.7	358 05.5	07.0	311 55.9	20.1	269 41.7	14.1	76 23.9	18.9
E 10	288 10.1	13 04.9	07.0	326 56.4	19.5	284 43.7	14.3	91 26.4	18.9
S 11	303 12.6	28 04.3	07.1	341 56.9	18.9	299 45.7	14.5	106 28.9	18.9
D 12	318 15.1	43 03.7	S21 07.1	356 57.4	S16 18.3	314 47.7	N 0 14.7	121 31.4	S 4 18.8
A 13	333 17.5	58 03.1	07.2	11 57.9	17.7	329 49.7	14.9	136 33.9	18.8
Y 14	348 20.0	73 02.5	07.2	26 58.4	17.1	344 51.7	15.1	151 36.4	18.8
15	3 22.5	88 01.9	07.2	41 58.9	16.4	359 53.7	15.3	166 39.0	18.7
16	18 24.9	103 01.3	07.3	56 59.4	15.8	14 55.7	15.5	181 41.5	18.7
17	33 27.4	118 00.7	07.3	72 00.0	15.2	29 57.6	15.7	196 44.0	18.7
18	48 29.8	133 00.1	S21 07.4	87 00.5	S16 14.6	44 59.6	N 0 16.0	211 46.5	S 4 18.6
19	63 32.3	147 59.5	07.4	102 01.0	14.0	60 01.6	16.2	226 49.0	18.6
20	78 34.8	162 58.9	07.5	117 01.5	13.4	75 03.6	16.4	241 51.5	18.6
21	93 37.2	177 58.3	07.5	132 02.0	12.8	90 05.6	16.6	256 54.0	18.5
22	108 39.7	192 57.7	07.5	147 02.5	12.1	105 07.6	16.8	271 56.6	18.5
23	123 42.2	207 57.1	07.6	162 03.0	11.5	120 09.6	17.0	286 59.1	18.5
	h m								
Mer. Pass.	14 50.5	v −0.6	d 0.1	v 0.5	d 0.6	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.8
Achernar	335 28.1	S57 11.0
Acrux	173 10.8	S63 09.6
Adhara	255 13.5	S28 59.5
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.7	N55 53.6
Alkaid	153 00.0	N49 15.1
Al Na'ir	27 46.2	S46 54.4
Alnilam	275 47.9	S 1 11.8
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.4	N26 40.4
Alpheratz	357 45.5	N29 09.3
Altair	62 10.2	N 8 53.8
Ankaa	353 17.5	S42 14.9
Antares	112 28.4	S26 27.4
Arcturus	145 57.2	N19 07.2
Atria	107 32.1	S69 02.6
Avior	234 18.1	S59 32.9
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.5	S52 42.4
Capella	280 36.7	N46 00.6
Deneb	49 33.1	N45 19.2
Denebola	182 35.1	N14 30.3
Diphda	348 57.7	S17 55.6
Dubhe	193 53.0	N61 41.1
Elnath	278 14.5	N28 37.0
Eltanin	90 47.3	N51 29.0
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.5	S57 10.5
Gienah	175 53.8	S17 36.4
Hadar	148 50.2	S60 25.4
Hamal	328 02.7	N23 31.0
Kaus Aust.	83 46.3	S34 22.7
Kochab	137 19.7	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.8	N 4 08.0
Menkent	148 09.5	S36 25.4
Miaplacidus	221 39.2	S69 45.9
Mirfak	308 42.7	N49 54.3
Nunki	76 00.7	S26 16.9
Peacock	53 22.4	S56 41.9
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.2	N12 33.0
Regulus	207 44.9	N11 54.5
Rigel	281 13.5	S 8 11.5
Rigil Kent.	139 54.0	S60 52.7
Sabik	102 14.6	S15 44.3
Schedar	349 42.9	N56 36.2
Shaula	96 24.4	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 32.9	S11 13.3
Suhail	222 53.3	S43 28.8
Vega	80 40.4	N38 47.5
Zuben'ubi	137 07.3	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	86 38.9	9 07
Mars	39 52.8	12 13
Jupiter	356 49.6	15 04
Saturn	163 14.7	3 59

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
6 00	176 29.9	S15 47.3	148 05.3	16.4	N 0 08.6	12.1	54.1
01	191 29.8	46.6	162 40.7	16.4	0 20.7	12.1	54.1
02	206 29.8	45.8	177 16.1	16.5	0 32.8	12.1	54.1
03	221 29.8	. . 45.0	191 51.6	16.4	0 44.9	12.1	54.1
04	236 29.7	44.3	206 27.0	16.4	0 57.0	12.1	54.1
05	251 29.7	43.5	221 02.4	16.5	1 09.1	12.1	54.1
06	266 29.6	S15 42.7	235 37.9	16.4	N 1 21.2	12.0	54.1
07	281 29.6	42.0	250 13.3	16.4	1 33.2	12.1	54.0
08	296 29.5	41.2	264 48.7	16.5	1 45.3	12.0	54.0
S 09	311 29.5	. . 40.4	279 24.2	16.4	1 57.3	12.1	54.0
U 10	326 29.4	39.7	293 59.6	16.5	2 09.4	12.0	54.0
N 11	341 29.4	38.9	308 35.1	16.4	2 21.4	12.0	54.0
D 12	356 29.4	S15 38.1	323 10.5	16.4	N 2 33.4	12.0	54.0
A 13	11 29.3	37.4	337 45.9	16.4	2 45.4	12.0	54.0
Y 14	26 29.3	36.6	352 21.3	16.5	2 57.4	12.0	54.0
15	41 29.2	. . 35.8	6 56.8	16.4	3 09.4	12.0	54.0
16	56 29.2	35.0	21 32.2	16.4	3 21.4	11.9	54.0
17	71 29.1	34.3	36 07.6	16.4	3 33.3	12.0	54.0
18	86 29.1	S15 33.5	50 43.0	16.4	N 3 45.3	11.9	54.0
19	101 29.1	32.7	65 18.4	16.3	3 57.2	11.9	54.0
20	116 29.0	32.0	79 53.7	16.4	4 09.1	11.9	54.0
21	131 29.0	. . 31.2	94 29.1	16.4	4 21.0	11.9	54.0
22	146 28.9	30.4	109 04.5	16.3	4 32.9	11.8	54.0
23	161 28.9	29.6	123 39.8	16.3	4 44.7	11.8	54.0
7 00	176 28.9	S15 28.9	138 15.1	16.4	N 4 56.5	11.8	54.0
01	191 28.8	28.1	152 50.5	16.3	5 08.3	11.8	54.0
02	206 28.8	27.3	167 25.8	16.2	5 20.1	11.8	54.0
03	221 28.7	. . 26.5	182 01.0	16.3	5 31.9	11.8	54.0
04	236 28.7	25.8	196 36.3	16.3	5 43.7	11.7	54.0
05	251 28.7	25.0	211 11.6	16.2	5 55.4	11.7	54.0
06	266 28.6	S15 24.2	225 46.8	16.2	N 6 07.1	11.7	54.0
07	281 28.6	23.4	240 22.0	16.2	6 18.8	11.6	54.0
08	296 28.6	22.6	254 57.2	16.2	6 30.4	11.7	54.0
M 09	311 28.5	. . 21.9	269 32.4	16.1	6 42.1	11.6	54.0
O 10	326 28.5	21.1	284 07.5	16.2	6 53.7	11.6	54.0
N 11	341 28.4	20.3	298 42.7	16.1	7 05.3	11.5	54.0
D 12	356 28.4	S15 19.5	313 17.8	16.1	N 7 16.8	11.5	54.0
A 13	11 28.4	18.7	327 52.9	16.0	7 28.3	11.5	54.0
Y 14	26 28.3	18.0	342 27.9	16.1	7 39.8	11.5	54.0
15	41 28.3	. . 17.2	357 03.0	16.0	7 51.3	11.5	54.0
16	56 28.3	16.4	11 38.0	15.9	8 02.8	11.4	54.1
17	71 28.2	15.6	26 12.9	16.0	8 14.2	11.3	54.1
18	86 28.2	S15 14.8	40 47.9	15.9	N 8 25.5	11.4	54.1
19	101 28.2	14.0	55 22.8	15.9	8 36.9	11.3	54.1
20	116 28.1	13.3	69 57.7	15.9	8 48.2	11.3	54.1
21	131 28.1	. . 12.5	84 32.6	15.8	8 59.5	11.3	54.1
22	146 28.1	11.7	99 07.4	15.8	9 10.8	11.2	54.1
23	161 28.1	10.9	113 42.2	15.8	9 22.0	11.2	54.1
8 00	176 28.0	S15 10.1	128 17.0	15.7	N 9 33.2	11.1	54.1
01	191 28.0	09.3	142 51.7	15.7	9 44.3	11.1	54.1
02	206 28.0	08.5	157 26.4	15.7	9 55.4	11.1	54.1
03	221 27.9	. . 07.8	172 01.1	15.6	10 06.5	11.0	54.1
04	236 27.9	07.0	186 35.7	15.6	10 17.5	11.0	54.1
05	251 27.9	06.2	201 10.3	15.5	10 28.5	11.0	54.1
06	266 27.8	S15 05.4	215 44.8	15.5	N10 39.5	10.9	54.1
07	281 27.8	04.6	230 19.3	15.5	10 50.4	10.9	54.1
T 08	296 27.8	03.8	244 53.8	15.4	11 01.3	10.8	54.1
U 09	311 27.8	. . 03.0	259 28.2	15.4	11 12.1	10.8	54.2
E 10	326 27.7	02.2	274 02.6	15.4	11 22.9	10.8	54.2
S 11	341 27.7	01.4	288 37.0	15.3	11 33.7	10.7	54.2
D 12	356 27.7	S15 00.7	303 11.3	15.2	N11 44.4	10.7	54.2
A 13	11 27.7	14 59.9	317 45.5	15.2	11 55.1	10.6	54.2
Y 14	26 27.6	59.1	332 19.7	15.2	12 05.7	10.6	54.2
15	41 27.6	. . 58.3	346 53.9	15.1	12 16.3	10.5	54.2
16	56 27.6	57.5	1 28.0	15.1	12 26.8	10.5	54.2
17	71 27.6	56.7	16 02.1	15.0	12 37.3	10.5	54.2
18	86 27.5	S14 55.9	30 36.1	15.0	N12 47.8	10.3	54.2
19	101 27.5	55.1	45 10.1	14.9	12 58.1	10.4	54.3
20	116 27.5	54.3	59 44.0	14.9	13 08.5	10.3	54.3
21	131 27.5	. . 53.5	74 17.9	14.8	13 18.8	10.2	54.3
22	146 27.4	52.7	88 51.7	14.8	13 29.0	10.2	54.3
23	161 27.4	51.9	103 25.5	14.8	N13 39.2	10.2	54.3
	SD 16.2	d 0.8	SD	14.7	14.7		14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 6	Moonrise 7	Moonrise 8	Moonrise 9
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 48	08 13	09 45	08 00	07 40	07 15	06 41
N 70	06 43	07 58	09 15	08 02	07 48	07 33	07 13
68	06 38	07 46	08 53	08 04	07 56	07 46	07 36
66	06 34	07 36	08 36	08 06	08 02	07 58	07 54
64	06 31	07 28	08 22	08 07	08 07	08 07	08 08
62	06 28	07 21	08 10	08 08	08 11	08 15	08 21
60	06 25	07 14	08 00	08 09	08 15	08 22	08 31
N 58	06 22	07 09	07 51	08 10	08 19	08 29	08 41
56	06 19	07 04	07 44	08 11	08 22	08 34	08 49
54	06 17	06 59	07 37	08 12	08 25	08 39	08 56
52	06 15	06 55	07 31	08 12	08 27	08 44	09 03
50	06 12	06 51	07 25	08 13	08 30	08 48	09 09
45	06 07	06 42	07 13	08 14	08 35	08 57	09 21
N 40	06 03	06 35	07 03	08 16	08 39	09 04	09 32
35	05 58	06 28	06 54	08 17	08 43	09 11	09 41
30	05 53	06 22	06 47	08 17	08 46	09 17	09 49
20	05 44	06 11	06 33	08 19	08 52	09 27	10 03
N 10	05 35	06 00	06 22	08 20	08 57	09 35	10 15
0	05 24	05 49	06 11	08 22	09 02	09 44	10 27
S 10	05 12	05 38	05 59	08 23	09 07	09 52	10 39
20	04 57	05 24	05 47	08 24	09 12	10 01	10 51
30	04 38	05 08	05 33	08 26	09 18	10 11	11 05
35	04 25	04 58	05 25	08 27	09 22	10 17	11 14
40	04 11	04 46	05 16	08 28	09 26	10 24	11 23
45	03 52	04 32	05 05	08 29	09 31	10 32	11 35
S 50	03 27	04 15	04 52	08 31	09 36	10 42	11 48
52	03 15	04 06	04 45	08 32	09 39	10 46	11 55
54	03 01	03 57	04 38	08 33	09 42	10 51	12 02
56	02 43	03 46	04 31	08 33	09 45	10 57	12 10
58	02 22	03 33	04 22	08 34	09 48	11 03	12 19
S 60	01 52	03 18	04 12	08 35	09 52	11 10	12 29

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 6	Moonset 7	Moonset 8	Moonset 9
°	h m	h m	h m	h m	h m	h m	h m
N 72	14 44	16 17	17 42	21 38	23 28	25 31	01 31
N 70	15 14	16 31	17 47	21 31	23 13	25 01	01 01
68	15 36	16 43	17 51	21 26	23 01	24 39	00 39
66	15 53	16 53	17 55	21 22	22 51	24 23	00 23
64	16 07	17 01	17 59	21 18	22 42	24 09	00 09
62	16 19	17 09	18 02	21 15	22 35	23 57	25 21
60	16 29	17 15	18 05	21 12	22 29	23 47	25 07
N 58	16 38	17 20	18 07	21 10	22 24	23 39	24 55
56	16 45	17 25	18 10	21 08	22 19	23 32	24 45
54	16 52	17 30	18 12	21 06	22 15	23 25	24 36
52	16 58	17 34	18 14	21 04	22 11	23 19	24 28
50	17 04	17 38	18 17	21 02	22 08	23 14	24 20
45	17 16	17 47	18 22	20 59	22 00	23 02	24 05
N 40	17 26	17 54	18 26	20 56	21 54	22 53	23 52
35	17 34	18 01	18 31	20 54	21 49	22 44	23 41
30	17 42	18 07	18 35	20 51	21 44	22 37	23 32
20	17 55	18 18	18 44	20 48	21 36	22 25	23 16
N 10	18 07	18 28	18 53	20 44	21 29	22 14	23 02
0	18 18	18 39	19 04	20 41	21 22	22 04	22 49
S 10	18 29	18 50	19 16	20 38	21 15	21 54	22 36
20	18 41	19 04	19 31	20 35	21 08	21 44	22 22
30	18 54	19 20	19 50	20 31	21 00	21 32	22 06
35	19 02	19 29	20 02	20 29	20 56	21 25	21 57
40	19 12	19 41	20 17	20 26	20 51	21 17	21 46
45	19 22	19 55	20 35	20 24	20 45	21 08	21 34
S 50	19 36	20 12	20 59	20 20	20 38	20 57	21 19
52	19 42	20 21	21 11	20 19	20 34	20 52	21 12
54	19 48	20 30	21 25	20 17	20 31	20 46	21 04
56	19 56	20 41	21 42	20 15	20 27	20 40	20 56
58	20 05	20 53	22 03	20 13	20 22	20 33	20 46
S 60	20 14	21 08	22 31	20 11	20 17	20 25	20 35

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
6	14 00	14 03	12 14	14 31	02 11	03	10
7	14 04	14 06	12 14	15 12	02 52	04	17
8	14 08	14 09	12 14	15 54	03 33	05	24

UT	ARIES	VENUS −4.3		MARS +1.1		JUPITER −2.1		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
9 00	138 44.6	222 56.5	S21 07.6	177 03.5	S16 10.9	135 11.6	N 0 17.2	302 01.6	S 4 18.4
01	153 47.1	237 55.9	07.7	192 04.0	10.3	150 13.6	17.4	317 04.1	18.4
02	168 49.6	252 55.3	07.7	207 04.6	09.7	165 15.6	17.6	332 06.6	18.4
03	183 52.0	267 54.6 . .	07.7	222 05.1 . .	09.1	180 17.5 . .	17.9	347 09.1 . .	18.3
04	198 54.5	282 54.0	07.8	237 05.6	08.5	195 19.5	18.1	2 11.7	18.3
05	213 57.0	297 53.4	07.8	252 06.1	07.8	210 21.5	18.3	17 14.2	18.3
06	228 59.4	312 52.8	S21 07.8	267 06.6	S16 07.2	225 23.5	N 0 18.5	32 16.7	S 4 18.2
W 07	244 01.9	327 52.2	07.9	282 07.1	06.6	240 25.5	18.7	47 19.2	18.2
E 08	259 04.3	342 51.6	07.9	297 07.6	06.0	255 27.5	18.9	62 21.7	18.2
D 09	274 06.8	357 51.0 . .	07.9	312 08.2 . .	05.4	270 29.5 . .	19.1	77 24.2 . .	18.1
N 10	289 09.3	12 50.4	07.9	327 08.7	04.7	285 31.5	19.3	92 26.8	18.1
E 11	304 11.7	27 49.8	08.0	342 09.2	04.1	300 33.5	19.6	107 29.3	18.1
S 12	319 14.2	42 49.2	S21 08.0	357 09.7	S16 03.5	315 35.4	N 0 19.8	122 31.8	S 4 18.0
D 13	334 16.7	57 48.6	08.0	12 10.2	02.9	330 37.4	20.0	137 34.3	18.0
A 14	349 19.1	72 47.9	08.0	27 10.7	02.3	345 39.4	20.2	152 36.8	18.0
Y 15	4 21.6	87 47.3 . .	08.1	42 11.2 . .	01.7	0 41.4 . .	20.4	167 39.4 . .	17.9
16	19 24.1	102 46.7	08.1	57 11.8	01.0	15 43.4	20.6	182 41.9	17.9
17	34 26.5	117 46.1	08.1	72 12.3	16 00.4	30 45.4	20.8	197 44.4	17.9
18	49 29.0	132 45.5	S21 08.1	87 12.8	S15 59.8	45 47.4	N 0 21.0	212 46.9	S 4 17.8
19	64 31.4	147 44.9	08.2	102 13.3	59.2	60 49.4	21.2	227 49.4	17.8
20	79 33.9	162 44.3	08.2	117 13.8	58.5	75 51.3	21.5	242 52.0	17.8
21	94 36.4	177 43.7 . .	08.2	132 14.3 . .	57.9	90 53.3 . .	21.7	257 54.5 . .	17.7
22	109 38.8	192 43.1	08.2	147 14.9	57.3	105 55.3	21.9	272 57.0	17.7
23	124 41.3	207 42.4	08.2	162 15.4	56.7	120 57.3	22.1	287 59.5	17.7
10 00	139 43.8	222 41.8	S21 08.2	177 15.9	S15 56.1	135 59.3	N 0 22.3	303 02.0	S 4 17.6
01	154 46.2	237 41.2	08.2	192 16.4	55.4	151 01.3	22.5	318 04.6	17.6
02	169 48.7	252 40.6	08.3	207 16.9	54.8	166 03.3	22.7	333 07.1	17.6
03	184 51.2	267 40.0 . .	08.3	222 17.4 . .	54.2	181 05.2 . .	22.9	348 09.6 . .	17.5
04	199 53.6	282 39.4	08.3	237 18.0	53.6	196 07.2	23.2	3 12.1	17.5
05	214 56.1	297 38.8	08.3	252 18.5	52.9	211 09.2	23.4	18 14.6	17.5
06	229 58.6	312 38.1	S21 08.3	267 19.0	S15 52.3	226 11.2	N 0 23.6	33 17.2	S 4 17.4
T 07	245 01.0	327 37.5	08.3	282 19.5	51.7	241 13.2	23.8	48 19.7	17.4
H 08	260 03.5	342 36.9	08.3	297 20.0	51.1	256 15.2	24.0	63 22.2	17.3
U 09	275 05.9	357 36.3 . .	08.3	312 20.6 . .	50.4	271 17.2 . .	24.2	78 24.7 . .	17.3
R 10	290 08.4	12 35.7	08.3	327 21.1	49.8	286 19.1	24.4	93 27.2	17.3
S 11	305 10.9	27 35.1	08.3	342 21.6	49.2	301 21.1	24.7	108 29.8	17.2
D 12	320 13.3	42 34.5	S21 08.3	357 22.1	S15 48.6	316 23.1	N 0 24.9	123 32.3	S 4 17.2
A 13	335 15.8	57 33.8	08.3	12 22.6	47.9	331 25.1	25.1	138 34.8	17.2
Y 14	350 18.3	72 33.2	08.3	27 23.1	47.3	346 27.1	25.3	153 37.3	17.1
15	5 20.7	87 32.6 . .	08.3	42 23.7 . .	46.7	1 29.1 . .	25.5	168 39.8 . .	17.1
16	20 23.2	102 32.0	08.3	57 24.2	46.1	16 31.1	25.7	183 42.4	17.1
17	35 25.7	117 31.4	08.3	72 24.7	45.4	31 33.0	25.9	198 44.9	17.0
18	50 28.1	132 30.7	S21 08.3	87 25.2	S15 44.8	46 35.0	N 0 26.1	213 47.4	S 4 17.0
19	65 30.6	147 30.1	08.3	102 25.8	44.2	61 37.0	26.4	228 49.9	17.0
20	80 33.1	162 29.5	08.3	117 26.3	43.6	76 39.0	26.6	243 52.5	16.9
21	95 35.5	177 28.9 . .	08.3	132 26.8 . .	42.9	91 41.0 . .	26.8	258 55.0 . .	16.9
22	110 38.0	192 28.3	08.3	147 27.3	42.3	106 43.0	27.0	273 57.5	16.8
23	125 40.4	207 27.7	08.3	162 27.8	41.7	121 44.9	27.2	289 00.0	16.8
11 00	140 42.9	222 27.0	S21 08.3	177 28.4	S15 41.0	136 46.9	N 0 27.4	304 02.6	S 4 16.8
01	155 45.4	237 26.4	08.3	192 28.9	40.4	151 48.9	27.6	319 05.1	16.7
02	170 47.8	252 25.8	08.3	207 29.4	39.8	166 50.9	27.9	334 07.6	16.7
03	185 50.3	267 25.2 . .	08.3	222 29.9 . .	39.2	181 52.9 . .	28.1	349 10.1 . .	16.7
04	200 52.8	282 24.6	08.3	237 30.4	38.5	196 54.9	28.3	4 12.7	16.6
05	215 55.2	297 23.9	08.2	252 31.0	37.9	211 56.8	28.5	19 15.2	16.6
06	230 57.7	312 23.3	S21 08.2	267 31.5	S15 37.3	226 58.8	N 0 28.7	34 17.7	S 4 16.6
07	246 00.2	327 22.7	08.2	282 32.0	36.6	242 00.8	28.9	49 20.2	16.5
08	261 02.6	342 22.1	08.2	297 32.5	36.0	257 02.8	29.1	64 22.8	16.5
F 09	276 05.1	357 21.5 . .	08.2	312 33.1 . .	35.4	272 04.8 . .	29.4	79 25.3 . .	16.4
R 10	291 07.5	12 20.8	08.2	327 33.6	34.7	287 06.8	29.6	94 27.8	16.4
I 11	306 10.0	27 20.2	08.1	342 34.1	34.1	302 08.7	29.8	109 30.3	16.4
D 12	321 12.5	42 19.6	S21 08.1	357 34.6	S15 33.5	317 10.7	N 0 30.0	124 32.9	S 4 16.3
A 13	336 14.9	57 19.0	08.1	12 35.2	32.8	332 12.7	30.2	139 35.4	16.3
Y 14	351 17.4	72 18.3	08.1	27 35.7	32.2	347 14.7	30.4	154 37.9	16.3
15	6 19.9	87 17.7 . .	08.1	42 36.2 . .	31.6	2 16.7 . .	30.6	169 40.4 . .	16.2
16	21 22.3	102 17.1	08.0	57 36.7	30.9	17 18.6	30.9	184 43.0	16.2
17	36 24.8	117 16.5	08.0	72 37.3	30.3	32 20.6	31.1	199 45.5	16.1
18	51 27.3	132 15.9	S21 08.0	87 37.8	S15 29.7	47 22.6	N 0 31.3	214 48.0	S 4 16.1
19	66 29.7	147 15.2	08.0	102 38.3	29.0	62 24.6	31.5	229 50.5	16.1
20	81 32.2	162 14.6	07.9	117 38.8	28.4	77 26.6	31.7	244 53.1	16.0
21	96 34.7	177 14.0 . .	07.9	132 39.4 . .	27.8	92 28.6 . .	31.9	259 55.6 . .	16.0
22	111 37.1	192 13.4	07.9	147 39.9	27.1	107 30.5	32.1	274 58.1	16.0
23	126 39.6	207 12.7	07.8	162 40.4	26.5	122 32.5	32.4	290 00.7	15.9
	h m								
Mer. Pass.	14 38.7	v −0.6	d 0.0	v 0.5	d 0.6	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.8
Achernar	335 28.1	S57 11.0
Acrux	173 10.8	S63 09.6
Adhara	255 13.5	S28 59.5
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.7	N55 53.6
Alkaid	152 59.9	N49 15.1
Al Na'ir	27 46.2	S46 54.4
Alnilam	275 47.9	S 1 11.8
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.4	N26 40.4
Alpheratz	357 45.5	N29 09.2
Altair	62 10.2	N 8 53.8
Ankaa	353 17.6	S42 14.9
Antares	112 28.4	S26 27.4
Arcturus	145 57.1	N19 07.2
Atria	107 32.0	S69 02.6
Avior	234 18.1	S59 32.9
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.5	S52 42.4
Capella	280 36.7	N46 00.6
Deneb	49 33.1	N45 19.2
Denebola	182 35.1	N14 30.3
Diphda	348 57.7	S17 55.6
Dubhe	193 53.0	N61 41.2
Elnath	278 14.5	N28 37.0
Eltanin	90 47.2	N51 29.0
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.5	S57 10.5
Gienah	175 53.8	S17 36.4
Hadar	148 50.2	S60 25.5
Hamal	328 02.8	N23 31.0
Kaus Aust.	83 46.3	S34 22.7
Kochab	137 19.6	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.8	N 4 08.0
Menkent	148 09.5	S36 25.5
Miaplacidus	221 39.2	S69 45.9
Mirfak	308 42.8	N49 54.3
Nunki	76 00.7	S26 16.9
Peacock	53 22.4	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.2	N12 33.0
Regulus	207 44.9	N11 54.5
Rigel	281 13.5	S 8 11.5
Rigil Kent.	139 54.0	S60 52.7
Sabik	102 14.6	S15 44.3
Schedar	349 42.9	N56 36.2
Shaula	96 24.4	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 32.9	S11 13.3
Suhail	222 53.3	S43 28.8
Vega	80 40.4	N38 47.5
Zuben'ubi	137 07.2	S16 05.3

	SHA	Mer. Pass.
	° ′	h m
Venus	82 58.1	9 10
Mars	37 32.1	12 11
Jupiter	356 15.5	14 54
Saturn	163 18.3	3 47

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
9 00	176 27.4	S14 51.1	117 59.3	14.6	N13 49.4	10.1	54.3
01	191 27.4	50.3	132 32.9	14.7	13 59.5	10.0	54.3
02	206 27.3	49.5	147 06.6	14.5	14 09.5	10.0	54.3
03	221 27.3	. . 48.7	161 40.1	14.5	14 19.5	9.9	54.3
04	236 27.3	47.9	176 13.6	14.5	14 29.4	9.9	54.4
05	251 27.3	47.1	190 47.1	14.4	14 39.3	9.8	54.4
06	266 27.3	S14 46.3	205 20.5	14.3	N14 49.1	9.8	54.4
W 07	281 27.2	45.5	219 53.8	14.3	14 58.9	9.7	54.4
E 08	296 27.2	44.7	234 27.1	14.2	15 08.6	9.7	54.4
D 09	311 27.2	. . 43.9	249 00.3	14.2	15 18.3	9.6	54.4
N 10	326 27.2	43.1	263 33.5	14.1	15 27.9	9.5	54.4
E 11	341 27.2	42.3	278 06.6	14.1	15 37.4	9.5	54.5
S 12	356 27.1	S14 41.5	292 39.7	14.0	N15 46.9	9.4	54.5
D 13	11 27.1	40.7	307 12.7	13.9	15 56.3	9.3	54.5
A 14	26 27.1	39.9	321 45.6	13.8	16 05.6	9.3	54.5
Y 15	41 27.1	. . 39.1	336 18.4	13.8	16 14.9	9.2	54.5
16	56 27.1	38.3	350 51.2	13.8	16 24.1	9.2	54.5
17	71 27.1	37.5	5 24.0	13.6	16 33.3	9.1	54.6
18	86 27.0	S14 36.7	19 56.6	13.7	N16 42.4	9.0	54.6
19	101 27.0	35.9	34 29.3	13.5	16 51.4	9.0	54.6
20	116 27.0	35.1	49 01.8	13.5	17 00.4	8.9	54.6
21	131 27.0	. . 34.3	63 34.3	13.4	17 09.3	8.8	54.6
22	146 27.0	33.5	78 06.7	13.3	17 18.1	8.7	54.7
23	161 27.0	32.7	92 39.0	13.3	17 26.8	8.7	54.7
10 00	176 27.0	S14 31.9	107 11.3	13.2	N17 35.5	8.6	54.7
01	191 26.9	31.1	121 43.5	13.1	17 44.1	8.6	54.7
02	206 26.9	30.3	136 15.6	13.1	17 52.7	8.4	54.7
03	221 26.9	. . 29.5	150 47.7	13.0	18 01.1	8.4	54.7
04	236 26.9	28.7	165 19.7	12.9	18 09.5	8.4	54.8
05	251 26.9	27.8	179 51.6	12.9	18 17.9	8.2	54.8
06	266 26.9	S14 27.0	194 23.5	12.8	N18 26.1	8.2	54.8
T 07	281 26.9	26.2	208 55.3	12.7	18 34.3	8.1	54.8
H 08	296 26.9	25.4	223 27.0	12.6	18 42.4	8.0	54.9
U 09	311 26.8	. . 24.6	237 58.6	12.6	18 50.4	7.9	54.9
R 10	326 26.8	23.8	252 30.2	12.5	18 58.3	7.9	54.9
S 11	341 26.8	23.0	267 01.7	12.4	19 06.2	7.7	54.9
D 12	356 26.8	S14 22.2	281 33.1	12.4	N19 13.9	7.7	54.9
A 13	11 26.8	21.4	296 04.5	12.2	19 21.6	7.7	55.0
Y 14	26 26.8	20.5	310 35.7	12.3	19 29.3	7.5	55.0
15	41 26.8	. . 19.7	325 07.0	12.1	19 36.8	7.4	55.0
16	56 26.8	18.9	339 38.1	12.0	19 44.2	7.4	55.0
17	71 26.8	18.1	354 09.1	12.0	19 51.6	7.3	55.1
18	86 26.8	S14 17.3	8 40.1	11.9	N19 58.9	7.2	55.1
19	101 26.8	16.5	23 11.0	11.8	20 06.1	7.1	55.1
20	116 26.7	15.7	37 41.8	11.8	20 13.2	7.0	55.1
21	131 26.7	. . 14.8	52 12.6	11.7	20 20.2	6.9	55.2
22	146 26.7	14.0	66 43.3	11.6	20 27.1	6.8	55.2
23	161 26.7	13.2	81 13.9	11.5	20 33.9	6.8	55.2
11 00	176 26.7	S14 12.4	95 44.4	11.4	N20 40.7	6.6	55.2
01	191 26.7	11.6	110 14.8	11.4	20 47.3	6.6	55.3
02	206 26.7	10.8	124 45.2	11.3	20 53.9	6.4	55.3
03	221 26.7	. . 09.9	139 15.5	11.2	21 00.3	6.4	55.3
04	236 26.7	09.1	153 45.7	11.1	21 06.7	6.3	55.3
05	251 26.7	08.3	168 15.8	11.1	21 13.0	6.2	55.4
06	266 26.7	S14 07.5	182 45.9	11.0	N21 19.2	6.0	55.4
07	281 26.7	06.7	197 15.9	10.9	21 25.2	6.0	55.4
08	296 26.7	05.9	211 45.8	10.8	21 31.2	5.9	55.5
F 09	311 26.7	. . 05.0	226 15.6	10.7	21 37.1	5.8	55.5
R 10	326 26.7	04.2	240 45.3	10.7	21 42.9	5.7	55.5
I 11	341 26.7	03.4	255 15.0	10.6	21 48.6	5.5	55.5
D 12	356 26.7	S14 02.6	269 44.6	10.5	N21 54.1	5.5	55.6
A 13	11 26.7	01.7	284 14.1	10.5	21 59.6	5.4	55.6
Y 14	26 26.7	00.9	298 43.6	10.3	22 05.0	5.2	55.6
15	41 26.7	14 00.1	313 12.9	10.3	22 10.2	5.2	55.7
16	56 26.7	13 59.3	327 42.2	10.2	22 15.4	5.0	55.7
17	71 26.7	58.5	342 11.4	10.1	22 20.4	5.0	55.7
18	86 26.7	S13 57.6	356 40.5	10.1	N22 25.4	4.8	55.7
19	101 26.7	56.8	11 09.6	10.0	22 30.2	4.8	55.8
20	116 26.7	56.0	25 38.6	9.9	22 35.0	4.6	55.8
21	131 26.7	. . 55.2	40 07.5	9.8	22 39.6	4.5	55.8
22	146 26.7	54.3	54 36.3	9.7	22 44.1	4.4	55.9
23	161 26.7	53.5	69 05.0	9.7	N22 48.5	4.2	55.9
	SD 16.2	d 0.8	SD 14.8		15.0		15.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 9	Moonrise 10	Moonrise 11	Moonrise 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 37	07 59	09 26	06 41			
N 70	06 33	07 46	09 00	07 13	06 39		
68	06 29	07 36	08 41	07 36	07 21	06 51	
66	06 26	07 27	08 25	07 54	07 50	07 46	07 43
64	06 23	07 20	08 12	08 08	08 12	08 19	08 36
62	06 20	07 13	08 02	08 21	08 29	08 43	09 08
60	06 18	07 07	07 52	08 31	08 44	09 03	09 32
N 58	06 16	07 02	07 44	08 41	08 57	09 19	09 52
56	06 14	06 58	07 37	08 49	09 08	09 33	10 08
54	06 12	06 54	07 31	08 56	09 17	09 45	10 22
52	06 10	06 50	07 25	09 03	09 26	09 55	10 34
50	06 08	06 46	07 20	09 09	09 33	10 05	10 44
45	06 04	06 38	07 09	09 21	09 50	10 24	11 07
N 40	06 00	06 31	07 00	09 32	10 04	10 41	11 25
35	05 55	06 25	06 51	09 41	10 15	10 54	11 40
30	05 51	06 20	06 44	09 49	10 25	11 06	11 53
20	05 43	06 09	06 32	10 03	10 43	11 27	12 16
N 10	05 34	05 59	06 21	10 15	10 58	11 45	12 35
0	05 25	05 49	06 11	10 27	11 13	12 02	12 54
S 10	05 13	05 39	06 00	10 39	11 27	12 18	13 12
20	04 59	05 26	05 49	10 51	11 43	12 37	13 32
30	04 41	05 11	05 36	11 05	12 01	12 57	13 55
35	04 29	05 01	05 28	11 14	12 11	13 10	14 08
40	04 15	04 50	05 20	11 23	12 23	13 24	14 23
45	03 57	04 37	05 09	11 35	12 38	13 41	14 42
S 50	03 34	04 21	04 57	11 48	12 55	14 02	15 05
52	03 23	04 13	04 51	11 55	13 04	14 12	15 16
54	03 10	04 04	04 45	12 02	13 13	14 23	15 29
56	02 54	03 54	04 38	12 10	13 23	14 36	15 43
58	02 34	03 42	04 29	12 19	13 35	14 51	16 00
S 60	02 09	03 28	04 20	12 29	13 49	15 08	16 21

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 9	Moonset 10	Moonset 11	Moonset 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	15 04	16 31	17 54	01 31			
N 70	15 30	16 44	17 58	01 01	03 08		
68	15 49	16 54	18 01	00 39	02 27	04 36	
66	16 05	17 03	18 04	00 23	01 59	03 42	05 32
64	16 17	17 10	18 07	00 09	01 38	03 10	04 39
62	16 28	17 16	18 09	25 21	01 21	02 46	04 07
60	16 37	17 22	18 11	25 07	01 07	02 27	03 43
N 58	16 45	17 27	18 14	24 55	00 55	02 11	03 24
56	16 52	17 32	18 16	24 45	00 45	01 58	03 08
54	16 58	17 36	18 18	24 36	00 36	01 46	02 54
52	17 04	17 40	18 19	24 28	00 28	01 36	02 43
50	17 09	17 43	18 21	24 20	00 20	01 27	02 32
45	17 20	17 51	18 25	24 05	00 05	01 08	02 10
N 40	17 29	17 57	18 29	23 52	24 52	00 52	01 53
35	17 37	18 04	18 33	23 41	24 39	00 39	01 38
30	17 44	18 09	18 37	23 32	24 28	00 28	01 25
20	17 57	18 19	18 45	23 16	24 08	00 08	01 03
N 10	18 07	18 29	18 54	23 02	23 52	24 44	00 44
0	18 18	18 39	19 04	22 49	23 36	24 26	00 26
S 10	18 28	18 50	19 15	22 36	23 20	24 08	00 08
20	18 39	19 02	19 29	22 22	23 03	23 50	24 41
30	18 52	19 17	19 47	22 06	22 44	23 28	24 18
35	19 00	19 26	19 59	21 57	22 33	23 15	24 04
40	19 08	19 37	20 12	21 46	22 20	23 00	23 48
45	19 18	19 50	20 30	21 34	22 05	22 43	23 30
S 50	19 30	20 07	20 52	21 19	21 47	22 21	23 06
52	19 36	20 14	21 04	21 12	21 38	22 11	22 55
54	19 42	20 23	21 17	21 04	21 28	22 00	22 43
56	19 49	20 33	21 32	20 56	21 17	21 47	22 28
58	19 57	20 45	21 51	20 46	21 05	21 31	22 11
S 60	20 06	20 58	22 15	20 35	20 50	21 13	21 50

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	%
9	14 10	14 11	12 14	16 38	04 16	06	33
10	14 12	14 13	12 14	17 24	05 01	07	42
11	14 13	14 13	12 14	18 14	05 49	08	52

UT	ARIES	VENUS −4.2		MARS +1.1		JUPITER −2.1		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
12 00	141 42.0	222 12.1	S21 07.8	177 40.9	S15 25.9	137 34.5	N 0 32.6	305 03.2	S 4 15.9
01	156 44.5	237 11.5	07.8	192 41.5	25.2	152 36.5	32.8	320 05.7	15.8
02	171 47.0	252 10.9	07.7	207 42.0	24.6	167 38.5	33.0	335 08.2	15.8
03	186 49.4	267 10.2	07.7	222 42.5	24.0	182 40.4	33.2	350 10.8	15.8
04	201 51.9	282 09.6	07.7	237 43.0	23.3	197 42.4	33.4	5 13.3	15.7
05	216 54.4	297 09.0	07.6	252 43.6	22.7	212 44.4	33.6	20 15.8	15.7
06	231 56.8	312 08.4	S21 07.6	267 44.1	S15 22.0	227 46.4	N 0 33.9	35 18.3	S 4 15.7
07	246 59.3	327 07.7	07.6	282 44.6	21.4	242 48.4	34.1	50 20.9	15.6
S 08	262 01.8	342 07.1	07.5	297 45.1	20.8	257 50.3	34.3	65 23.4	15.6
A 09	277 04.2	357 06.5	07.5	312 45.7	20.1	272 52.3	34.5	80 25.9	15.5
T 10	292 06.7	12 05.9	07.4	327 46.2	19.5	287 54.3	34.7	95 28.5	15.5
U 11	307 09.2	27 05.2	07.4	342 46.7	18.9	302 56.3	34.9	110 31.0	15.5
R 12	322 11.6	42 04.6	S21 07.3	357 47.3	S15 18.2	317 58.3	N 0 35.2	125 33.5	S 4 15.4
D 13	337 14.1	57 04.0	07.3	12 47.8	17.6	333 00.2	35.4	140 36.1	15.4
A 14	352 16.5	72 03.3	07.3	27 48.3	16.9	348 02.2	35.6	155 38.6	15.3
Y 15	7 19.0	87 02.7	07.2	42 48.8	16.3	3 04.2	35.8	170 41.1	15.3
16	22 21.5	102 02.1	07.2	57 49.4	15.7	18 06.2	36.0	185 43.6	15.3
17	37 23.9	117 01.5	07.1	72 49.9	15.0	33 08.1	36.2	200 46.2	15.2
18	52 26.4	132 00.8	S21 07.1	87 50.4	S15 14.4	48 10.1	N 0 36.4	215 48.7	S 4 15.2
19	67 28.9	147 00.2	07.0	102 51.0	13.7	63 12.1	36.7	230 51.2	15.2
20	82 31.3	161 59.6	07.0	117 51.5	13.1	78 14.1	36.9	245 53.8	15.1
21	97 33.8	176 59.0	06.9	132 52.0	12.5	93 16.1	37.1	260 56.3	15.1
22	112 36.3	191 58.3	06.9	147 52.5	11.8	108 18.0	37.3	275 58.8	15.0
23	127 38.7	206 57.7	06.8	162 53.1	11.2	123 20.0	37.5	291 01.4	15.0
13 00	142 41.2	221 57.1	S21 06.8	177 53.6	S15 10.5	138 22.0	N 0 37.7	306 03.9	S 4 15.0
01	157 43.7	236 56.4	06.7	192 54.1	09.9	153 24.0	38.0	321 06.4	14.9
02	172 46.1	251 55.8	06.6	207 54.7	09.2	168 26.0	38.2	336 09.0	14.9
03	187 48.6	266 55.2	06.6	222 55.2	08.6	183 27.9	38.4	351 11.5	14.8
04	202 51.0	281 54.5	06.5	237 55.7	08.0	198 29.9	38.6	6 14.0	14.8
05	217 53.5	296 53.9	06.5	252 56.3	07.3	213 31.9	38.8	21 16.6	14.8
06	232 56.0	311 53.3	S21 06.4	267 56.8	S15 06.7	228 33.9	N 0 39.0	36 19.1	S 4 14.7
07	247 58.4	326 52.7	06.3	282 57.3	06.0	243 35.8	39.3	51 21.6	14.7
08	263 00.9	341 52.0	06.3	297 57.9	05.4	258 37.8	39.5	66 24.2	14.6
S 09	278 03.4	356 51.4	06.2	312 58.4	04.7	273 39.8	39.7	81 26.7	14.6
U 10	293 05.8	11 50.8	06.1	327 58.9	04.1	288 41.8	39.9	96 29.2	14.6
N 11	308 08.3	26 50.1	06.1	342 59.5	03.4	303 43.7	40.1	111 31.7	14.5
D 12	323 10.8	41 49.5	S21 06.0	358 00.0	S15 02.8	318 45.7	N 0 40.3	126 34.3	S 4 14.5
A 13	338 13.2	56 48.9	05.9	13 00.5	02.2	333 47.7	40.6	141 36.8	14.4
Y 14	353 15.7	71 48.2	05.9	28 01.1	01.5	348 49.7	40.8	156 39.4	14.4
15	8 18.1	86 47.6	05.8	43 01.6	00.9	3 51.6	41.0	171 41.9	14.4
16	23 20.6	101 47.0	05.7	58 02.1	15 00.2	18 53.6	41.2	186 44.4	14.3
17	38 23.1	116 46.3	05.7	73 02.7	14 59.6	33 55.6	41.4	201 47.0	14.3
18	53 25.5	131 45.7	S21 05.6	88 03.2	S14 58.9	48 57.6	N 0 41.6	216 49.5	S 4 14.2
19	68 28.0	146 45.1	05.5	103 03.7	58.3	63 59.6	41.9	231 52.0	14.2
20	83 30.5	161 44.4	05.4	118 04.3	57.6	79 01.5	42.1	246 54.6	14.2
21	98 32.9	176 43.8	05.4	133 04.8	57.0	94 03.5	42.3	261 57.1	14.1
22	113 35.4	191 43.2	05.3	148 05.3	56.3	109 05.5	42.5	276 59.6	14.1
23	128 37.9	206 42.5	05.2	163 05.9	55.7	124 07.5	42.7	292 02.2	14.0
14 00	143 40.3	221 41.9	S21 05.1	178 06.4	S14 55.0	139 09.4	N 0 42.9	307 04.7	S 4 14.0
01	158 42.8	236 41.3	05.1	193 06.9	54.4	154 11.4	43.2	322 07.2	14.0
02	173 45.3	251 40.6	05.0	208 07.5	53.7	169 13.4	43.4	337 09.8	13.9
03	188 47.7	266 40.0	04.9	223 08.0	53.1	184 15.4	43.6	352 12.3	13.9
04	203 50.2	281 39.4	04.8	238 08.5	52.4	199 17.3	43.8	7 14.8	13.8
05	218 52.6	296 38.7	04.7	253 09.1	51.8	214 19.3	44.0	22 17.4	13.8
06	233 55.1	311 38.1	S21 04.6	268 09.6	S14 51.1	229 21.3	N 0 44.2	37 19.9	S 4 13.8
07	248 57.6	326 37.5	04.6	283 10.1	50.5	244 23.3	44.5	52 22.4	13.7
08	264 00.0	341 36.8	04.5	298 10.7	49.8	259 25.2	44.7	67 25.0	13.7
M 09	279 02.5	356 36.2	04.4	313 11.2	49.2	274 27.2	44.9	82 27.5	13.6
O 10	294 05.0	11 35.6	04.3	328 11.8	48.5	289 29.2	45.1	97 30.1	13.6
N 11	309 07.4	26 34.9	04.2	343 12.3	47.9	304 31.1	45.3	112 32.6	13.5
D 12	324 09.9	41 34.3	S21 04.1	358 12.8	S14 47.2	319 33.1	N 0 45.5	127 35.1	S 4 13.5
A 13	339 12.4	56 33.7	04.0	13 13.4	46.6	334 35.1	45.8	142 37.7	13.5
Y 14	354 14.8	71 33.0	03.9	28 13.9	45.9	349 37.1	46.0	157 40.2	13.4
15	9 17.3	86 32.4	03.8	43 14.4	45.3	4 39.0	46.2	172 42.7	13.4
16	24 19.8	101 31.8	03.7	58 15.0	44.6	19 41.0	46.4	187 45.3	13.3
17	39 22.2	116 31.1	03.6	73 15.5	44.0	34 43.0	46.6	202 47.8	13.3
18	54 24.7	131 30.5	S21 03.6	88 16.1	S14 43.3	49 45.0	N 0 46.8	217 50.4	S 4 13.3
19	69 27.1	146 29.8	03.5	103 16.6	42.7	64 46.9	47.1	232 52.9	13.2
20	84 29.6	161 29.2	03.4	118 17.1	42.0	79 48.9	47.3	247 55.4	13.2
21	99 32.1	176 28.6	03.3	133 17.7	41.4	94 50.9	47.5	262 58.0	13.1
22	114 34.5	191 27.9	03.2	148 18.2	40.7	109 52.9	47.7	278 00.5	13.1
23	129 37.0	206 27.3	03.1	163 18.7	40.0	124 54.8	47.9	293 03.1	13.0
	h m								
Mer. Pass.	14 26.9	v −0.6	d 0.1	v 0.5	d 0.6	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.8
Achernar	335 28.2	S57 11.0
Acrux	173 10.8	S63 09.6
Adhara	255 13.5	S28 59.5
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.7	N55 53.6
Alkaid	152 59.9	N49 15.1
Al Na'ir	27 46.2	S46 54.4
Alnilam	275 47.9	S 1 11.8
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.4	N26 40.3
Alpheratz	357 45.5	N29 09.2
Altair	62 10.2	N 8 53.8
Ankaa	353 17.6	S42 14.9
Antares	112 28.4	S26 27.4
Arcturus	145 57.1	N19 07.2
Atria	107 32.0	S69 02.6
Avior	234 18.1	S59 32.9
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.5	S52 42.4
Capella	280 36.7	N46 00.6
Deneb	49 33.1	N45 19.2
Denebola	182 35.1	N14 30.3
Diphda	348 57.7	S17 55.6
Dubhe	193 53.0	N61 41.2
Elnath	278 14.5	N28 37.0
Eltanin	90 47.2	N51 29.0
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.4	S57 10.5
Gienah	175 53.8	S17 36.4
Hadar	148 50.1	S60 25.5
Hamal	328 02.8	N23 31.0
Kaus Aust.	83 46.3	S34 22.7
Kochab	137 19.6	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.8	N 4 08.0
Menkent	148 09.4	S36 25.5
Miaplacidus	221 39.2	S69 45.9
Mirfak	308 42.8	N49 54.3
Nunki	76 00.6	S26 16.9
Peacock	53 22.3	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.2	N12 33.0
Regulus	207 44.9	N11 54.5
Rigel	281 13.5	S 8 11.5
Rigil Kent.	139 53.9	S60 52.7
Sabik	102 14.6	S15 44.3
Schedar	349 42.9	N56 36.2
Shaula	96 24.4	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 32.8	S11 13.3
Suhail	222 53.3	S43 28.9
Vega	80 40.4	N38 47.5
Zuben'ubi	137 07.2	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	79 15.9	9 13
Mars	35 12.4	12 08
Jupiter	355 40.8	14 45
Saturn	163 22.7	3 35

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
12 00	176 26.7	S13 52.7	83 33.7	9.6	N22 52.7	4.2	55.9
01	191 26.7	51.9	98 02.3	9.5	22 56.9	4.0	56.0
02	206 26.7	51.0	112 30.8	9.5	23 00.9	4.0	56.0
03	221 26.7	. . 50.2	126 59.3	9.4	23 04.9	3.8	56.0
04	236 26.7	49.4	141 27.7	9.3	23 08.7	3.7	56.1
05	251 26.7	48.5	155 56.0	9.2	23 12.4	3.6	56.1
06	266 26.7	S13 47.7	170 24.2	9.1	N23 16.0	3.4	56.1
07	281 26.7	46.9	184 52.3	9.1	23 19.4	3.4	56.2
S 08	296 26.7	46.1	199 20.4	9.0	23 22.8	3.2	56.2
A 09	311 26.7	. . 45.2	213 48.4	9.0	23 26.0	3.1	56.2
T 10	326 26.7	44.4	228 16.4	8.9	23 29.1	3.0	56.3
U 11	341 26.7	43.6	242 44.3	8.8	23 32.1	2.8	56.3
R 12	356 26.7	S13 42.7	257 12.1	8.7	N23 34.9	2.7	56.3
D 13	11 26.7	41.9	271 39.8	8.7	23 37.6	2.6	56.4
A 14	26 26.8	41.1	286 07.5	8.6	23 40.2	2.5	56.4
Y 15	41 26.8	. . 40.2	300 35.1	8.5	23 42.7	2.3	56.4
16	56 26.8	39.4	315 02.6	8.5	23 45.0	2.3	56.5
17	71 26.8	38.6	329 30.1	8.4	23 47.3	2.0	56.5
18	86 26.8	S13 37.7	343 57.5	8.3	N23 49.3	2.0	56.6
19	101 26.8	36.9	358 24.8	8.3	23 51.3	1.8	56.6
20	116 26.8	36.1	12 52.1	8.2	23 53.1	1.7	56.6
21	131 26.8	. . 35.2	27 19.3	8.1	23 54.8	1.6	56.7
22	146 26.8	34.4	41 46.4	8.1	23 56.4	1.4	56.7
23	161 26.8	33.6	56 13.5	8.0	23 57.8	1.3	56.7
13 00	176 26.8	S13 32.7	70 40.5	8.0	N23 59.1	1.2	56.8
01	191 26.9	31.9	85 07.5	7.9	24 00.3	1.0	56.8
02	206 26.9	31.1	99 34.4	7.8	24 01.3	0.9	56.8
03	221 26.9	. . 30.2	114 01.2	7.8	24 02.2	0.8	56.9
04	236 26.9	29.4	128 28.0	7.8	24 03.0	0.6	56.9
05	251 26.9	28.5	142 54.8	7.6	24 03.6	0.5	57.0
06	266 26.9	S13 27.7	157 21.4	7.7	N24 04.1	0.3	57.0
07	281 26.9	26.9	171 48.1	7.5	24 04.4	0.2	57.0
08	296 26.9	26.0	186 14.6	7.5	24 04.6	0.1	57.1
S 09	311 27.0	. . 25.2	200 41.1	7.5	24 04.7	0.1	57.1
U 10	326 27.0	24.4	215 07.6	7.4	24 04.6	0.2	57.2
N 11	341 27.0	23.5	229 34.0	7.4	24 04.4	0.3	57.2
D 12	356 27.0	S13 22.7	244 00.4	7.3	N24 04.1	0.5	57.2
A 13	11 27.0	21.8	258 26.7	7.3	24 03.6	0.7	57.3
Y 14	26 27.0	21.0	272 53.0	7.2	24 02.9	0.8	57.3
15	41 27.0	. . 20.2	287 19.2	7.2	24 02.1	0.9	57.4
16	56 27.1	19.3	301 45.4	7.2	24 01.2	1.1	57.4
17	71 27.1	18.5	316 11.6	7.1	24 00.1	1.2	57.4
18	86 27.1	S13 17.6	330 37.7	7.0	N23 58.9	1.3	57.5
19	101 27.1	16.8	345 03.7	7.0	23 57.6	1.5	57.5
20	116 27.1	15.9	359 29.7	7.0	23 56.1	1.7	57.5
21	131 27.1	. . 15.1	13 55.7	7.0	23 54.4	1.8	57.6
22	146 27.2	14.3	28 21.7	6.9	23 52.6	1.9	57.6
23	161 27.2	13.4	42 47.6	6.9	23 50.7	2.1	57.7
14 00	176 27.2	S13 12.6	57 13.5	6.8	N23 48.6	2.2	57.7
01	191 27.2	11.7	71 39.3	6.8	23 46.4	2.4	57.7
02	206 27.2	10.9	86 05.1	6.8	23 44.0	2.5	57.8
03	221 27.3	. . 10.0	100 30.9	6.7	23 41.5	2.7	57.8
04	236 27.3	09.2	114 56.6	6.8	23 38.8	2.8	57.9
05	251 27.3	08.3	129 22.4	6.7	23 36.0	3.0	57.9
06	266 27.3	S13 07.5	143 48.1	6.6	N23 33.0	3.1	57.9
07	281 27.3	06.6	158 13.7	6.7	23 29.9	3.3	58.0
08	296 27.4	05.8	172 39.4	6.6	23 26.6	3.4	58.0
M 09	311 27.4	. . 04.9	187 05.0	6.6	23 23.2	3.6	58.1
O 10	326 27.4	04.1	201 30.6	6.6	23 19.6	3.7	58.1
N 11	341 27.4	03.3	215 56.2	6.5	23 15.9	3.9	58.2
D 12	356 27.4	S13 02.4	230 21.7	6.6	N23 12.0	4.0	58.2
A 13	11 27.5	01.6	244 47.3	6.5	23 08.0	4.1	58.2
Y 14	26 27.5	13 00.7	259 12.8	6.5	23 03.9	4.4	58.3
15	41 27.5	12 59.9	273 38.3	6.5	22 59.5	4.4	58.3
16	56 27.5	59.0	288 03.8	6.5	22 55.1	4.6	58.4
17	71 27.6	58.2	302 29.3	6.5	22 50.5	4.8	58.4
18	86 27.6	S12 57.3	316 54.8	6.4	N22 45.7	4.9	58.4
19	101 27.6	56.4	331 20.2	6.5	22 40.8	5.1	58.5
20	116 27.6	55.6	345 45.7	6.4	22 35.7	5.2	58.5
21	131 27.7	. . 54.7	0 11.1	6.4	22 30.5	5.3	58.6
22	146 27.7	53.9	14 36.5	6.5	22 25.2	5.5	58.6
23	161 27.7	53.0	29 02.0	6.4	N22 19.7	5.7	58.6
	SD 16.2	d 0.8	SD	15.4	15.6		15.9

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 12	Moonrise 13	Moonrise 14	Moonrise 15
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 24	07 45	09 07				
N 70	06 22	07 34	08 45				
68	06 19	07 25	08 28				10 47
66	06 17	07 17	08 14	07 43	07 50	09 35	11 39
64	06 15	07 11	08 03	08 36	09 15	10 30	12 11
62	06 13	07 05	07 53	09 08	09 53	11 03	12 34
60	06 11	07 00	07 45	09 32	10 19	11 27	12 53
N 58	06 10	06 56	07 37	09 52	10 40	11 46	13 09
56	06 08	06 52	07 31	10 08	10 57	12 02	13 22
54	06 06	06 48	07 25	10 22	11 12	12 16	13 33
52	06 05	06 44	07 20	10 34	11 24	12 28	13 43
50	06 03	06 41	07 15	10 44	11 35	12 39	13 52
45	06 00	06 34	07 05	11 07	11 59	13 01	14 11
N 40	05 56	06 28	06 56	11 25	12 17	13 18	14 27
35	05 53	06 23	06 49	11 40	12 33	13 33	14 40
30	05 49	06 17	06 42	11 53	12 47	13 46	14 51
20	05 42	06 08	06 31	12 16	13 10	14 08	15 11
N 10	05 34	05 59	06 20	12 35	13 30	14 28	15 27
0	05 25	05 50	06 11	12 54	13 49	14 45	15 43
S 10	05 14	05 39	06 01	13 12	14 07	15 03	15 59
20	05 01	05 28	05 51	13 32	14 27	15 22	16 15
30	04 44	05 13	05 38	13 55	14 51	15 44	16 34
35	04 33	05 05	05 31	14 08	15 04	15 57	16 46
40	04 19	04 54	05 23	14 23	15 20	16 12	16 58
45	04 03	04 42	05 14	14 42	15 39	16 30	17 13
S 50	03 41	04 26	05 02	15 05	16 02	16 51	17 32
52	03 31	04 19	04 57	15 16	16 14	17 02	17 40
54	03 18	04 11	04 51	15 29	16 26	17 13	17 50
56	03 04	04 01	04 44	15 43	16 41	17 27	18 01
58	02 46	03 50	04 37	16 00	16 58	17 42	18 13
S 60	02 24	03 38	04 28	16 21	17 20	18 01	18 27

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 12	Moonset 13	Moonset 14	Moonset 15
°	h m	h m	h m	h m	h m	h m	h m
N 72	15 23	16 45	18 06				
N 70	15 45	16 56	18 09				
68	16 02	17 05	18 11				08 20
66	16 16	17 12	18 13	05 32	07 18	07 31	07 28
64	16 27	17 19	18 15	04 39	05 53	06 36	06 55
62	16 37	17 24	18 17	04 07	05 15	06 03	06 31
60	16 45	17 29	18 18	03 43	04 49	05 38	06 12
N 58	16 52	17 34	18 20	03 24	04 28	05 19	05 56
56	16 59	17 38	18 22	03 08	04 11	05 03	05 42
54	17 04	17 41	18 23	02 54	03 56	04 49	05 30
52	17 10	17 45	18 24	02 43	03 44	04 37	05 20
50	17 14	17 48	18 26	02 32	03 33	04 26	05 10
45	17 24	17 55	18 29	02 10	03 09	04 03	04 50
N 40	17 33	18 01	18 33	01 53	02 51	03 45	04 34
35	17 40	18 06	18 36	01 38	02 35	03 30	04 20
30	17 47	18 11	18 40	01 25	02 22	03 17	04 08
20	17 58	18 21	18 47	01 03	01 58	02 54	03 48
N 10	18 08	18 30	18 55	00 44	01 38	02 34	03 30
0	18 18	18 39	19 04	00 26	01 20	02 16	03 13
S 10	18 27	18 49	19 14	00 08	01 01	01 57	02 56
20	18 38	19 00	19 27	24 41	00 41	01 37	02 38
30	18 50	19 15	19 44	24 18	00 18	01 14	02 17
35	18 56	19 23	19 55	24 04	00 04	01 01	02 04
40	19 04	19 33	20 08	23 48	24 45	00 45	01 50
45	19 14	19 45	20 24	23 30	24 27	00 27	01 33
S 50	19 25	20 01	20 45	23 06	24 03	00 03	01 12
52	19 30	20 08	20 56	22 55	23 52	25 02	01 02
54	19 36	20 16	21 08	22 43	23 39	24 51	00 51
56	19 43	20 25	21 22	22 28	23 25	24 38	00 38
58	19 50	20 36	21 39	22 11	23 08	24 22	00 22
S 60	19 58	20 48	22 00	21 50	22 47	24 04	00 04

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
12	14 13	14 13	12 14	19 07	06 40	09	62
13	14 13	14 12	12 14	20 02	07 34	10	72
14	14 11	14 10	12 14	20 59	08 31	11	81

UT	ARIES	VENUS −4.2		MARS +1.1		JUPITER −2.1		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
15 00	144 39.5	221 26.7	S21 03.0	178 19.3	S14 39.4	139 56.8	N 0 48.2	308 05.6	S 4 13.0
01	159 41.9	236 26.0	02.8	193 19.8	38.7	154 58.8	48.4	323 08.1	13.0
02	174 44.4	251 25.4	02.7	208 20.4	38.1	170 00.7	48.6	338 10.7	12.9
03	189 46.9	266 24.7	02.6	223 20.9	37.4	185 02.7	48.8	353 13.2	12.9
04	204 49.3	281 24.1	02.5	238 21.4	36.8	200 04.7	49.0	8 15.8	12.8
05	219 51.8	296 23.5	02.4	253 22.0	36.1	215 06.7	49.2	23 18.3	12.8
06	234 54.3	311 22.8	S21 02.3	268 22.5	S14 35.5	230 08.6	N 0 49.5	38 20.8	S 4 12.8
07	249 56.7	326 22.2	02.2	283 23.1	34.8	245 10.6	49.7	53 23.4	12.7
T 08	264 59.2	341 21.6	02.1	298 23.6	34.1	260 12.6	49.9	68 25.9	12.7
U 09	280 01.6	356 20.9	02.0	313 24.2	33.5	275 14.5	50.1	83 28.5	12.6
E 10	295 04.1	11 20.3	01.9	328 24.7	32.8	290 16.5	50.3	98 31.0	12.6
S 11	310 06.6	26 19.6	01.8	343 25.2	32.2	305 18.5	50.6	113 33.5	12.5
D 12	325 09.0	41 19.0	S21 01.6	358 25.8	S14 31.5	320 20.5	N 0 50.8	128 36.1	S 4 12.5
A 13	340 11.5	56 18.4	01.5	13 26.3	30.9	335 22.4	51.0	143 38.6	12.5
Y 14	355 14.0	71 17.7	01.4	28 26.9	30.2	350 24.4	51.2	158 41.2	12.4
15	10 16.4	86 17.1	01.3	43 27.4	29.5	5 26.4	51.4	173 43.7	12.4
16	25 18.9	101 16.4	01.2	58 27.9	28.9	20 28.3	51.6	188 46.2	12.3
17	40 21.4	116 15.8	01.1	73 28.5	28.2	35 30.3	51.9	203 48.8	12.3
18	55 23.8	131 15.2	S21 00.9	88 29.0	S14 27.6	50 32.3	N 0 52.1	218 51.3	S 4 12.2
19	70 26.3	146 14.5	00.8	103 29.6	26.9	65 34.3	52.3	233 53.9	12.2
20	85 28.8	161 13.9	00.7	118 30.1	26.2	80 36.2	52.5	248 56.4	12.2
21	100 31.2	176 13.2	00.6	133 30.7	25.6	95 38.2	52.7	263 59.0	12.1
22	115 33.7	191 12.6	00.4	148 31.2	24.9	110 40.2	53.0	279 01.5	12.1
23	130 36.1	206 12.0	00.3	163 31.7	24.3	125 42.1	53.2	294 04.0	12.0
16 00	145 38.6	221 11.3	S21 00.2	178 32.3	S14 23.6	140 44.1	N 0 53.4	309 06.6	S 4 12.0
01	160 41.1	236 10.7	21 00.1	193 32.8	22.9	155 46.1	53.6	324 09.1	11.9
02	175 43.5	251 10.0	20 59.9	208 33.4	22.3	170 48.0	53.8	339 11.7	11.9
03	190 46.0	266 09.4	59.8	223 33.9	21.6	185 50.0	54.1	354 14.2	11.8
04	205 48.5	281 08.8	59.7	238 34.5	21.0	200 52.0	54.3	9 16.8	11.8
05	220 50.9	296 08.1	59.6	253 35.0	20.3	215 54.0	54.5	24 19.3	11.8
06	235 53.4	311 07.5	S20 59.4	268 35.6	S14 19.6	230 55.9	N 0 54.7	39 21.8	S 4 11.7
W 07	250 55.9	326 06.8	59.3	283 36.1	19.0	245 57.9	54.9	54 24.4	11.7
E 08	265 58.3	341 06.2	59.2	298 36.6	18.3	260 59.9	55.2	69 26.9	11.6
D 09	281 00.8	356 05.6	59.0	313 37.2	17.6	276 01.8	55.4	84 29.5	11.6
N 10	296 03.2	11 04.9	58.9	328 37.7	17.0	291 03.8	55.6	99 32.0	11.5
E 11	311 05.7	26 04.3	58.7	343 38.3	16.3	306 05.8	55.8	114 34.6	11.5
S 12	326 08.2	41 03.6	S20 58.6	358 38.8	S14 15.7	321 07.7	N 0 56.0	129 37.1	S 4 11.5
D 13	341 10.6	56 03.0	58.5	13 39.4	15.0	336 09.7	56.2	144 39.6	11.4
A 14	356 13.1	71 02.3	58.3	28 39.9	14.3	351 11.7	56.5	159 42.2	11.4
Y 15	11 15.6	86 01.7	58.2	43 40.5	13.7	6 13.6	56.7	174 44.7	11.3
16	26 18.0	101 01.1	58.0	58 41.0	13.0	21 15.6	56.9	189 47.3	11.3
17	41 20.5	116 00.4	57.9	73 41.6	12.3	36 17.6	57.1	204 49.8	11.2
18	56 23.0	130 59.8	S20 57.8	88 42.1	S14 11.7	51 19.5	N 0 57.3	219 52.4	S 4 11.2
19	71 25.4	145 59.1	57.6	103 42.7	11.0	66 21.5	57.6	234 54.9	11.1
20	86 27.9	160 58.5	57.5	118 43.2	10.3	81 23.5	57.8	249 57.5	11.1
21	101 30.4	175 57.9	57.3	133 43.7	09.7	96 25.4	58.0	265 00.0	11.1
22	116 32.8	190 57.2	57.2	148 44.3	09.0	111 27.4	58.2	280 02.6	11.0
23	131 35.3	205 56.6	57.0	163 44.8	08.3	126 29.4	58.4	295 05.1	11.0
17 00	146 37.7	220 55.9	S20 56.9	178 45.4	S14 07.7	141 31.3	N 0 58.7	310 07.7	S 4 10.9
01	161 40.2	235 55.3	56.7	193 45.9	07.0	156 33.3	58.9	325 10.2	10.9
02	176 42.7	250 54.6	56.6	208 46.5	06.3	171 35.3	59.1	340 12.7	10.8
03	191 45.1	265 54.0	56.4	223 47.0	05.7	186 37.3	59.3	355 15.3	10.8
04	206 47.6	280 53.4	56.3	238 47.6	05.0	201 39.2	59.5	10 17.8	10.7
05	221 50.1	295 52.7	56.1	253 48.1	04.3	216 41.2	0 59.8	25 20.4	10.7
06	236 52.5	310 52.1	S20 56.0	268 48.7	S14 03.7	231 43.2	N 1 00.0	40 22.9	S 4 10.6
07	251 55.0	325 51.4	55.8	283 49.2	03.0	246 45.1	00.2	55 25.5	10.6
T 08	266 57.5	340 50.8	55.6	298 49.8	02.3	261 47.1	00.4	70 28.0	10.6
H 09	281 59.9	355 50.1	55.5	313 50.3	01.7	276 49.0	00.6	85 30.6	10.5
U 10	297 02.4	10 49.5	55.3	328 50.9	01.0	291 51.0	00.9	100 33.1	10.5
R 11	312 04.9	25 48.8	55.2	343 51.4	14 00.3	306 53.0	01.1	115 35.7	10.4
S 12	327 07.3	40 48.2	S20 55.0	358 52.0	S13 59.6	321 54.9	N 1 01.3	130 38.2	S 4 10.4
D 13	342 09.8	55 47.6	54.8	13 52.5	59.0	336 56.9	01.5	145 40.8	10.3
A 14	357 12.2	70 46.9	54.7	28 53.1	58.3	351 58.9	01.7	160 43.3	10.3
Y 15	12 14.7	85 46.3	54.5	43 53.6	57.6	7 00.8	02.0	175 45.9	10.2
16	27 17.2	100 45.6	54.3	58 54.2	57.0	22 02.8	02.2	190 48.4	10.2
17	42 19.6	115 45.0	54.2	73 54.7	56.3	37 04.8	02.4	205 51.0	10.1
18	57 22.1	130 44.3	S20 54.0	88 55.3	S13 55.6	52 06.7	N 1 02.6	220 53.5	S 4 10.1
19	72 24.6	145 43.7	53.8	103 55.8	55.0	67 08.7	02.8	235 56.1	10.1
20	87 27.0	160 43.0	53.7	118 56.4	54.3	82 10.7	03.1	250 58.6	10.0
21	102 29.5	175 42.4	53.5	133 56.9	53.6	97 12.6	03.3	266 01.2	10.0
22	117 32.0	190 41.8	53.3	148 57.5	52.9	112 14.6	03.5	281 03.7	09.9
23	132 34.4	205 41.1	53.1	163 58.0	52.3	127 16.6	03.7	296 06.3	09.9
	h m								
Mer. Pass.	14 15.1	v −0.6	d 0.1	v 0.5	d 0.7	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.8
Achernar	335 28.2	S57 11.0
Acrux	173 10.7	S63 09.6
Adhara	255 13.5	S28 59.5
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.6	N55 53.6
Alkaid	152 59.9	N49 15.1
Al Na'ir	27 46.2	S46 54.4
Alnilam	275 47.9	S 1 11.8
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.4	N26 40.3
Alpheratz	357 45.5	N29 09.2
Altair	62 10.1	N 8 53.8
Ankaa	353 17.6	S42 14.8
Antares	112 28.4	S26 27.4
Arcturus	145 57.1	N19 07.2
Atria	107 31.9	S69 02.6
Avior	234 18.2	S59 32.9
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.5	S52 42.4
Capella	280 36.7	N46 00.7
Deneb	49 33.1	N45 19.2
Denebola	182 35.0	N14 30.3
Diphda	348 57.7	S17 55.6
Dubhe	193 52.9	N61 41.2
Elnath	278 14.5	N28 37.0
Eltanin	90 47.2	N51 29.0
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.4	S57 10.5
Gienah	175 53.8	S17 36.4
Hadar	148 50.1	S60 25.5
Hamal	328 02.8	N23 31.0
Kaus Aust.	83 46.2	S34 22.7
Kochab	137 19.5	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.8	N 4 08.0
Menkent	148 09.4	S36 25.5
Miaplacidus	221 39.2	S69 46.0
Mirfak	308 42.8	N49 54.3
Nunki	76 00.6	S26 16.9
Peacock	53 22.3	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.1	N12 33.0
Regulus	207 44.9	N11 54.5
Rigel	281 13.5	S 8 11.5
Rigil Kent.	139 53.9	S60 52.7
Sabik	102 14.6	S15 44.3
Schedar	349 42.9	N56 36.1
Shaula	96 24.3	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 32.8	S11 13.3
Suhail	222 53.3	S43 28.9
Vega	80 40.4	N38 47.5
Zuben'ubi	137 07.2	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	75 32.7	9 16
Mars	32 53.7	12 05
Jupiter	355 05.5	14 35
Saturn	163 28.0	3 23

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
15 00	176 27.7	S12 52.2	43 27.4	6.4	N22 14.0	5.8	58.7
01	191 27.8	51.3	57 52.8	6.5	22 08.2	5.9	58.7
02	206 27.8	50.5	72 18.3	6.4	22 02.3	6.1	58.8
03	221 27.8	. . 49.6	86 43.7	6.4	21 56.2	6.2	58.8
04	236 27.8	48.8	101 09.1	6.4	21 50.0	6.4	58.8
05	251 27.9	47.9	115 34.5	6.4	21 43.6	6.6	58.9
06	266 27.9	S12 47.1	129 59.9	6.5	N21 37.0	6.6	58.9
07	281 27.9	46.2	144 25.4	6.4	21 30.4	6.9	59.0
08	296 28.0	45.3	158 50.8	6.5	21 23.5	6.9	59.0
09	311 28.0	. . 44.5	173 16.3	6.4	21 16.6	7.1	59.0
10	326 28.0	43.6	187 41.7	6.5	21 09.5	7.3	59.1
11	341 28.0	42.8	202 07.2	6.4	21 02.2	7.4	59.1
12	356 28.1	S12 41.9	216 32.6	6.5	N20 54.8	7.5	59.1
13	11 28.1	41.1	230 58.1	6.5	20 47.3	7.7	59.2
14	26 28.1	40.2	245 23.6	6.5	20 39.6	7.8	59.2
15	41 28.2	. . 39.3	259 49.1	6.5	20 31.8	8.0	59.3
16	56 28.2	38.5	274 14.6	6.5	20 23.8	8.1	59.3
17	71 28.2	37.6	288 40.1	6.6	20 15.7	8.3	59.3
18	86 28.3	S12 36.8	303 05.7	6.5	N20 07.4	8.3	59.4
19	101 28.3	35.9	317 31.2	6.6	19 59.1	8.6	59.4
20	116 28.3	35.0	331 56.8	6.6	19 50.5	8.6	59.5
21	131 28.4	. . 34.2	346 22.4	6.6	19 41.9	8.8	59.5
22	146 28.4	33.3	0 48.0	6.7	19 33.1	9.0	59.5
23	161 28.4	32.5	15 13.7	6.6	19 24.1	9.0	59.6
16 00	176 28.5	S12 31.6	29 39.3	6.7	N19 15.1	9.2	59.6
01	191 28.5	30.7	44 05.0	6.7	19 05.9	9.4	59.6
02	206 28.5	29.9	58 30.7	6.7	18 56.5	9.4	59.7
03	221 28.6	. . 29.0	72 56.4	6.7	18 47.1	9.6	59.7
04	236 28.6	28.1	87 22.1	6.8	18 37.5	9.8	59.7
05	251 28.6	27.3	101 47.9	6.8	18 27.7	9.8	59.8
06	266 28.7	S12 26.4	116 13.7	6.8	N18 17.9	10.0	59.8
07	281 28.7	25.6	130 39.5	6.9	18 07.9	10.1	59.8
08	296 28.7	24.7	145 05.4	6.8	17 57.8	10.3	59.9
09	311 28.8	. . 23.8	159 31.2	6.9	17 47.5	10.3	59.9
10	326 28.8	23.0	173 57.1	6.9	17 37.2	10.5	59.9
11	341 28.9	22.1	188 23.0	7.0	17 26.7	10.6	60.0
12	356 28.9	S12 21.2	202 49.0	7.0	N17 16.1	10.7	60.0
13	11 28.9	20.4	217 15.0	7.0	17 05.4	10.9	60.0
14	26 29.0	19.5	231 41.0	7.0	16 54.5	11.0	60.1
15	41 29.0	. . 18.6	246 07.0	7.1	16 43.5	11.1	60.1
16	56 29.0	17.8	260 33.1	7.1	16 32.4	11.2	60.1
17	71 29.1	16.9	274 59.2	7.1	16 21.2	11.3	60.2
18	86 29.1	S12 16.0	289 25.3	7.1	N16 09.9	11.4	60.2
19	101 29.2	15.2	303 51.4	7.2	15 58.5	11.6	60.2
20	116 29.2	14.3	318 17.6	7.3	15 46.9	11.7	60.3
21	131 29.2	. . 13.4	332 43.9	7.2	15 35.2	11.7	60.3
22	146 29.3	12.6	347 10.1	7.3	15 23.5	11.9	60.3
23	161 29.3	11.7	1 36.4	7.3	15 11.6	12.0	60.4
17 00	176 29.4	S12 10.8	16 02.7	7.3	N14 59.6	12.1	60.4
01	191 29.4	09.9	30 29.0	7.4	14 47.5	12.2	60.4
02	206 29.5	09.1	44 55.4	7.4	14 35.3	12.3	60.4
03	221 29.5	. . 08.2	59 21.8	7.5	14 23.0	12.4	60.5
04	236 29.5	07.3	73 48.3	7.5	14 10.6	12.5	60.5
05	251 29.6	06.5	88 14.8	7.5	13 58.1	12.6	60.5
06	266 29.6	S12 05.6	102 41.3	7.5	N13 45.5	12.7	60.5
07	281 29.7	04.7	117 07.8	7.6	13 32.8	12.8	60.6
08	296 29.7	03.8	131 34.4	7.6	13 20.0	12.9	60.6
09	311 29.8	. . 03.0	146 01.0	7.6	13 07.1	13.0	60.6
10	326 29.8	02.1	160 27.6	7.7	12 54.1	13.1	60.6
11	341 29.8	01.2	174 54.3	7.7	12 41.0	13.2	60.7
12	356 29.9	S12 00.3	189 21.0	7.7	N12 27.8	13.2	60.7
13	11 29.9	11 59.5	203 47.7	7.8	12 14.6	13.4	60.7
14	26 30.0	58.6	218 14.5	7.8	12 01.2	13.4	60.7
15	41 30.0	. . 57.7	232 41.3	7.8	11 47.8	13.5	60.8
16	56 30.1	56.8	247 08.1	7.9	11 34.3	13.6	60.8
17	71 30.1	56.0	261 35.0	7.9	11 20.7	13.7	60.8
18	86 30.2	S11 55.1	276 01.9	7.9	N11 07.0	13.8	60.8
19	101 30.2	54.2	290 28.8	8.0	10 53.2	13.8	60.8
20	116 30.3	53.3	304 55.8	8.0	10 39.4	13.9	60.9
21	131 30.3	. . 52.5	319 22.8	8.0	10 25.5	14.0	60.9
22	146 30.4	51.6	333 49.8	8.0	10 11.5	14.0	60.9
23	161 30.4	50.7	348 16.8	8.1	N 9 57.5	14.2	60.9
	SD 16.2	d 0.9	SD	16.1		16.4	16.5

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 15	Moonrise 16	Moonrise 17	Moonrise 18
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 12	07 31	08 50	▭	11 40	14 51	17 20
N 70	06 10	07 22	08 31	▭	12 42	15 13	17 28
68	06 09	07 14	08 15	10 47	13 17	15 29	17 35
66	06 08	07 08	08 03	11 39	13 42	15 43	17 40
64	06 06	07 02	07 53	12 11	14 01	15 53	17 45
62	06 05	06 57	07 44	12 34	14 17	16 03	17 49
60	06 04	06 53	07 36	12 53	14 30	16 11	17 52
N 58	06 03	06 49	07 30	13 09	14 41	16 17	17 55
56	06 02	06 45	07 24	13 22	14 50	16 24	17 58
54	06 01	06 42	07 19	13 33	14 59	16 29	18 00
52	06 00	06 39	07 14	13 43	15 07	16 34	18 02
50	05 58	06 36	07 09	13 52	15 13	16 38	18 04
45	05 56	06 30	07 00	14 11	15 28	16 48	18 08
N 40	05 53	06 24	06 52	14 27	15 40	16 56	18 12
35	05 50	06 20	06 45	14 40	15 50	17 02	18 15
30	05 47	06 15	06 39	14 51	15 59	17 08	18 18
20	05 40	06 06	06 29	15 11	16 14	17 18	18 22
N 10	05 33	05 58	06 20	15 27	16 28	17 27	18 26
0	05 25	05 50	06 11	15 43	16 40	17 36	18 30
S 10	05 15	05 40	06 02	15 59	16 52	17 44	18 34
20	05 03	05 29	05 52	16 15	17 05	17 53	18 38
30	04 46	05 16	05 41	16 34	17 20	18 03	18 43
35	04 36	05 08	05 34	16 46	17 29	18 09	18 45
40	04 24	04 58	05 27	16 58	17 39	18 15	18 48
45	04 08	04 47	05 18	17 13	17 51	18 23	18 52
S 50	03 48	04 32	05 08	17 32	18 04	18 32	18 56
52	03 38	04 25	05 03	17 40	18 11	18 36	18 58
54	03 27	04 18	04 57	17 50	18 18	18 40	19 00
56	03 13	04 09	04 51	18 01	18 26	18 45	19 02
58	02 58	03 59	04 44	18 13	18 35	18 51	19 04
S 60	02 38	03 47	04 37	18 27	18 45	18 57	19 07

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 15	Moonset 16	Moonset 17	Moonset 18
°	h m	h m	h m	h m	h m	h m	h m
N 72	15 40	16 58	18 19	▭	09 30	08 17	07 44
N 70	15 59	17 08	18 20	▭	08 26	07 54	07 33
68	16 14	17 15	18 21	08 20	07 50	07 35	07 24
66	16 26	17 22	18 22	07 28	07 24	07 20	07 17
64	16 37	17 27	18 23	06 55	07 04	07 08	07 10
62	16 45	17 32	18 24	06 31	06 47	06 58	07 04
60	16 53	17 37	18 25	06 12	06 34	06 49	07 00
N 58	16 59	17 40	18 26	05 56	06 22	06 41	06 55
56	17 05	17 44	18 27	05 42	06 11	06 33	06 51
54	17 10	17 47	18 28	05 30	06 02	06 27	06 48
52	17 15	17 50	18 30	05 20	05 54	06 21	06 45
50	17 19	17 53	18 31	05 10	05 46	06 16	06 42
45	17 29	17 59	18 33	04 50	05 31	06 05	06 35
N 40	17 37	18 04	18 36	04 34	05 17	05 56	06 30
35	17 43	18 09	18 39	04 20	05 06	05 48	06 25
30	17 49	18 14	18 42	04 08	04 56	05 40	06 21
20	18 00	18 22	18 48	03 48	04 39	05 28	06 14
N 10	18 09	18 30	18 55	03 30	04 24	05 17	06 08
0	18 17	18 39	19 03	03 13	04 10	05 07	06 02
S 10	18 26	18 48	19 13	02 56	03 56	04 56	05 55
20	18 36	18 59	19 25	02 38	03 41	04 45	05 49
30	18 47	19 12	19 41	02 17	03 23	04 32	05 41
35	18 53	19 20	19 51	02 04	03 13	04 24	05 37
40	19 01	19 29	20 04	01 50	03 01	04 16	05 32
45	19 09	19 40	20 19	01 33	02 47	04 06	05 26
S 50	19 20	19 55	20 38	01 12	02 30	03 53	05 19
52	19 24	20 01	20 48	01 02	02 22	03 47	05 16
54	19 30	20 09	20 59	00 51	02 13	03 41	05 12
56	19 36	20 17	21 12	00 38	02 02	03 34	05 08
58	19 42	20 27	21 28	00 22	01 51	03 26	05 03
S 60	19 50	20 38	21 47	00 04	01 37	03 17	04 58

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
15	14 09	14 08	12 14	21 57	09 28	12	89
16	14 06	14 05	12 14	22 53	10 25	13	95
17	14 03	14 01	12 14	23 49	11 21	14	99

UT	ARIES	VENUS −4.2		MARS +1.1		JUPITER −2.1		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
18 00	147 36.9	220 40.5	S20 53.0	178 58.6	S13 51.6	142 18.5	N 1 03.9	311 08.8	S 4 09.8
01	162 39.3	235 39.8	52.8	193 59.2	50.9	157 20.5	04.2	326 11.4	09.8
02	177 41.8	250 39.2	52.6	208 59.7	50.2	172 22.5	04.4	341 13.9	09.7
03	192 44.3	265 38.5	52.4	224 00.3	49.6	187 24.4	04.6	356 16.5	09.7
04	207 46.7	280 37.9	52.3	239 00.8	48.9	202 26.4	04.8	11 19.0	09.6
05	222 49.2	295 37.2	52.1	254 01.4	48.2	217 28.4	05.1	26 21.6	09.6
06	237 51.7	310 36.6	S20 51.9	269 01.9	S13 47.6	232 30.3	N 1 05.3	41 24.1	S 4 09.5
07	252 54.1	325 35.9	51.7	284 02.5	46.9	247 32.3	05.5	56 26.7	09.5
08	267 56.6	340 35.3	51.5	299 03.0	46.2	262 34.2	05.7	71 29.2	09.4
F 09	282 59.1	355 34.7	51.4	314 03.6	45.5	277 36.2	05.9	86 31.8	09.4
R 10	298 01.5	10 34.0	51.2	329 04.1	44.9	292 38.2	06.2	101 34.3	09.4
I 11	313 04.0	25 33.4	51.0	344 04.7	44.2	307 40.1	06.4	116 36.9	09.3
D 12	328 06.5	40 32.7	S20 50.8	359 05.2	S13 43.5	322 42.1	N 1 06.6	131 39.4	S 4 09.3
A 13	343 08.9	55 32.1	50.6	14 05.8	42.8	337 44.1	06.8	146 42.0	09.2
Y 14	358 11.4	70 31.4	50.4	29 06.4	42.2	352 46.0	07.0	161 44.5	09.2
15	13 13.8	85 30.8	50.2	44 06.9	41.5	7 48.0	07.3	176 47.1	09.1
16	28 16.3	100 30.1	50.1	59 07.5	40.8	22 50.0	07.5	191 49.6	09.1
17	43 18.8	115 29.5	49.9	74 08.0	40.1	37 51.9	07.7	206 52.2	09.0
18	58 21.2	130 28.8	S20 49.7	89 08.6	S13 39.4	52 53.9	N 1 07.9	221 54.7	S 4 09.0
19	73 23.7	145 28.2	49.5	104 09.1	38.8	67 55.8	08.1	236 57.3	08.9
20	88 26.2	160 27.5	49.3	119 09.7	38.1	82 57.8	08.4	251 59.8	08.9
21	103 28.6	175 26.9	49.1	134 10.2	37.4	97 59.8	08.6	267 02.4	08.8
22	118 31.1	190 26.3	48.9	149 10.8	36.7	113 01.7	08.8	282 05.0	08.8
23	133 33.6	205 25.6	48.7	164 11.4	36.1	128 03.7	09.0	297 07.5	08.7
19 00	148 36.0	220 25.0	S20 48.5	179 11.9	S13 35.4	143 05.7	N 1 09.3	312 10.1	S 4 08.7
01	163 38.5	235 24.3	48.3	194 12.5	34.7	158 07.6	09.5	327 12.6	08.6
02	178 41.0	250 23.7	48.1	209 13.0	34.0	173 09.6	09.7	342 15.2	08.6
03	193 43.4	265 23.0	47.9	224 13.6	33.3	188 11.5	09.9	357 17.7	08.5
04	208 45.9	280 22.4	47.7	239 14.1	32.7	203 13.5	10.1	12 20.3	08.5
05	223 48.3	295 21.7	47.5	254 14.7	32.0	218 15.5	10.4	27 22.8	08.5
06	238 50.8	310 21.1	S20 47.3	269 15.3	S13 31.3	233 17.4	N 1 10.6	42 25.4	S 4 08.4
07	253 53.3	325 20.4	47.1	284 15.8	30.6	248 19.4	10.8	57 27.9	08.4
S 08	268 55.7	340 19.8	46.9	299 16.4	29.9	263 21.4	11.0	72 30.5	08.3
A 09	283 58.2	355 19.1	46.7	314 16.9	29.3	278 23.3	11.2	87 33.1	08.3
T 10	299 00.7	10 18.5	46.5	329 17.5	28.6	293 25.3	11.5	102 35.6	08.2
U 11	314 03.1	25 17.8	46.3	344 18.0	27.9	308 27.2	11.7	117 38.2	08.2
R 12	329 05.6	40 17.2	S20 46.0	359 18.6	S13 27.2	323 29.2	N 1 11.9	132 40.7	S 4 08.1
D 13	344 08.1	55 16.5	45.8	14 19.2	26.5	338 31.2	12.1	147 43.3	08.1
A 14	359 10.5	70 15.9	45.6	29 19.7	25.9	353 33.1	12.4	162 45.8	08.0
Y 15	14 13.0	85 15.3	45.4	44 20.3	25.2	8 35.1	12.6	177 48.4	08.0
16	29 15.4	100 14.6	45.2	59 20.8	24.5	23 37.0	12.8	192 50.9	07.9
17	44 17.9	115 14.0	45.0	74 21.4	23.8	38 39.0	13.0	207 53.5	07.9
18	59 20.4	130 13.3	S20 44.8	89 22.0	S13 23.1	53 41.0	N 1 13.2	222 56.1	S 4 07.8
19	74 22.8	145 12.7	44.5	104 22.5	22.4	68 42.9	13.5	237 58.6	07.8
20	89 25.3	160 12.0	44.3	119 23.1	21.8	83 44.9	13.7	253 01.2	07.7
21	104 27.8	175 11.4	44.1	134 23.6	21.1	98 46.8	13.9	268 03.7	07.7
22	119 30.2	190 10.7	43.9	149 24.2	20.4	113 48.8	14.1	283 06.3	07.6
23	134 32.7	205 10.1	43.7	164 24.8	19.7	128 50.8	14.4	298 08.8	07.6
20 00	149 35.2	220 09.4	S20 43.4	179 25.3	S13 19.0	143 52.7	N 1 14.6	313 11.4	S 4 07.5
01	164 37.6	235 08.8	43.2	194 25.9	18.3	158 54.7	14.8	328 14.0	07.5
02	179 40.1	250 08.1	43.0	209 26.4	17.7	173 56.6	15.0	343 16.5	07.4
03	194 42.6	265 07.5	42.8	224 27.0	17.0	188 58.6	15.2	358 19.1	07.4
04	209 45.0	280 06.8	42.5	239 27.6	16.3	204 00.6	15.5	13 21.6	07.3
05	224 47.5	295 06.2	42.3	254 28.1	15.6	219 02.5	15.7	28 24.2	07.3
06	239 49.9	310 05 5	S20 42.1	269 28.7	S13 14.9	234 04.5	N 1 15.9	43 26.7	S 4 07.2
07	254 52.4	325 04.9	41.9	284 29.3	14.2	249 06.4	16.1	58 29.3	07.2
08	269 54.9	340 04.2	41.6	299 29.8	13.6	264 08.4	16.4	73 31.9	07.1
S 09	284 57.3	355 03.6	41.4	314 30.4	12.9	279 10.4	16.6	88 34.4	07.1
U 10	299 59.8	10 02.9	41.2	329 30.9	12.2	294 12.3	16.8	103 37.0	07.0
N 11	315 02.3	25 02.3	40.9	344 31.5	11.5	309 14.3	17.0	118 39.5	07.0
D 12	330 04.7	40 01.6	S20 40.7	359 32.1	S13 10.8	324 16.2	N 1 17.3	133 42.1	S 4 06.9
A 13	345 07.2	55 01.0	40.5	14 32.6	10.1	339 18.2	17.5	148 44.7	06.9
Y 14	0 09.7	70 00.4	40.2	29 33.2	09.4	354 20.1	17.7	163 47.2	06.8
15	15 12.1	84 59.7	40.0	44 33.8	08.7	9 22.1	17.9	178 49.8	06.8
16	30 14.6	99 59.1	39.8	59 34.3	08.1	24 24.1	18.1	193 52.3	06.7
17	45 17.0	114 58.4	39.5	74 34.9	07.4	39 26.0	18.4	208 54.9	06.7
18	60 19.5	129 57.8	S20 39.3	89 35.5	S13 06.7	54 28.0	N 1 18.6	223 57.5	S 4 06.6
19	75 22.0	144 57.1	39.0	104 36.0	06.0	69 29.9	18.8	239 00.0	06.6
20	90 24.4	159 56.5	38.8	119 36.6	05.3	84 31.9	19.0	254 02.6	06.5
21	105 26.9	174 55.8	38.5	134 37.1	04.6	99 33.9	19.3	269 05.1	06.5
22	120 29.4	189 55.2	38.3	149 37.7	03.9	114 35.8	19.5	284 07.7	06.4
23	135 31.8	204 54.5	38.1	164 38.3	03.2	129 37.8	19.7	299 10.3	06.4
	h m								
Mer. Pass.	14 03.3	*v* −0.6	*d* 0.2	*v* 0.6	*d* 0.7	*v* 2.0	*d* 0.2	*v* 2.6	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.8
Achernar	335 28.2	S57 11.0
Acrux	173 10.7	S63 09.6
Adhara	255 13.6	S28 59.5
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.6	N55 53.6
Alkaid	152 59.8	N49 15.1
Al Na'ir	27 46.2	S46 54.4
Alnilam	275 47.9	S 1 11.8
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.3	N26 40.3
Alpheratz	357 45.5	N29 09.2
Altair	62 10.1	N 8 53.8
Ankaa	353 17.6	S42 14.8
Antares	112 28.3	S26 27.4
Arcturus	145 57.1	N19 07.2
Atria	107 31.9	S69 02.6
Avior	234 18.2	S59 33.0
Bellatrix	278 33.6	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.6	S52 42.4
Capella	280 36.7	N46 00.7
Deneb	49 33.1	N45 19.2
Denebola	182 35.0	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.9	N61 41.2
Elnath	278 14.5	N28 37.0
Eltanin	90 47.2	N51 29.0
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.4	S57 10.5
Gienah	175 53.7	S17 36.4
Hadar	148 50.0	S60 25.5
Hamal	328 02.8	N23 31.0
Kaus Aust.	83 46.2	S34 22.7
Kochab	137 19.4	N74 06.2
Markab	13 40.3	N15 16.0
Menkar	314 16.8	N 4 08.0
Menkent	148 09.4	S36 25.5
Miaplacidus	221 39.3	S69 46.0
Mirfak	308 42.8	N49 54.2
Nunki	76 00.6	S26 16.9
Peacock	53 22.3	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.1	N12 33.0
Regulus	207 44.9	N11 54.5
Rigel	281 13.5	S 8 11.5
Rigil Kent.	139 53.8	S60 52.7
Sabik	102 14.5	S15 44.3
Schedar	349 42.9	N56 36.1
Shaula	96 24.3	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 32.8	S11 13.3
Suhail	222 53.3	S43 28.9
Vega	80 40.3	N38 47.4
Zuben'ubi	137 07.2	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	71 48.9	9 19
Mars	30 35.9	12 03
Jupiter	354 29.6	14 26
Saturn	163 34.0	3 11

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
18 00	176 30.5	S11 49.8	2 43.9	8.1	N 9 43.3	14.2	60.9
01	191 30.5	49.0	17 11.0	8.1	9 29.1	14.2	61.0
02	206 30.6	48.1	31 38.1	8.2	9 14.9	14.3	61.0
03	221 30.6	47.2	46 05.3	8.2	9 00.6	14.4	61.0
04	236 30.7	46.3	60 32.5	8.2	8 46.2	14.5	61.0
05	251 30.7	45.4	74 59.7	8.3	8 31.7	14.5	61.0
06	266 30.8	S11 44.6	89 27.0	8.2	N 8 17.2	14.6	61.0
07	281 30.8	43.7	103 54.2	8.3	8 02.6	14.6	61.0
08	296 30.9	42.8	118 21.5	8.4	7 48.0	14.7	61.1
F 09	311 30.9	41.9	132 48.9	8.3	7 33.3	14.7	61.1
R 10	326 31.0	41.0	147 16.2	8.4	7 18.6	14.8	61.1
I 11	341 31.0	40.2	161 43.6	8.4	7 03.8	14.8	61.1
D 12	356 31.1	S11 39.3	176 11.0	8.4	N 6 49.0	14.9	61.1
A 13	11 31.1	38.4	190 38.4	8.5	6 34.1	14.9	61.1
Y 14	26 31.2	37.5	205 05.9	8.4	6 19.2	15.0	61.1
15	41 31.2	36.6	219 33.3	8.5	6 04.2	15.0	61.1
16	56 31.3	35.7	234 00.8	8.5	5 49.2	15.0	61.1
17	71 31.3	34.9	248 28.3	8.6	5 34.2	15.1	61.1
18	86 31.4	S11 34.0	262 55.9	8.5	N 5 19.1	15.1	61.2
19	101 31.4	33.1	277 23.4	8.6	5 04.0	15.2	61.2
20	116 31.5	32.2	291 51.0	8.6	4 48.8	15.1	61.2
21	131 31.5	31.3	306 18.6	8.6	4 33.7	15.3	61.2
22	146 31.6	30.4	320 46.2	8.6	4 18.4	15.2	61.2
23	161 31.7	29.5	335 13.8	8.7	4 03.2	15.3	61.2
19 00	176 31.7	S11 28.7	349 41.5	8.6	N 3 47.9	15.3	61.2
01	191 31.8	27.8	4 09.1	8.7	3 32.6	15.3	61.2
02	206 31.8	26.9	18 36.8	8.7	3 17.3	15.3	61.2
03	221 31.9	26.0	33 04.5	8.7	3 02.0	15.4	61.2
04	236 31.9	25.1	47 32.2	8.8	2 46.6	15.3	61.2
05	251 32.0	24.2	62 00.0	8.7	2 31.3	15.4	61.2
06	266 32.1	S11 23.3	76 27.7	8.7	N 2 15.9	15.4	61.2
07	281 32.1	22.5	90 55.4	8.8	2 00.5	15.4	61.2
S 08	296 32.2	21.6	105 23.2	8.8	1 45.1	15.5	61.2
A 09	311 32.2	20.7	119 51.0	8.7	1 29.6	15.4	61.2
T 10	326 32.3	19.8	134 18.7	8.8	1 14.2	15.4	61.2
U 11	341 32.3	18.9	148 46.5	8.8	0 58.8	15.5	61.2
R 12	356 32.4	S11 18.0	163 14.3	8.8	N 0 43.3	15.4	61.2
D 13	11 32.5	17.1	177 42.1	8.9	0 27.9	15.5	61.2
A 14	26 32.5	16.2	192 10.0	8.8	N 0 12.4	15.4	61.2
Y 15	41 32.6	15.3	206 37.8	8.8	S 0 03.0	15.4	61.2
16	56 32.6	14.4	221 05.6	8.8	0 18.4	15.5	61.2
17	71 32.7	13.6	235 33.4	8.9	0 33.9	15.4	61.2
18	86 32.8	S11 12.7	250 01.3	8.8	S 0 49.3	15.4	61.2
19	101 32.8	11.8	264 29.1	8.8	1 04.7	15.4	61.2
20	116 32.9	10.9	278 56.9	8.9	1 20.1	15.4	61.2
21	131 33.0	10.0	293 24.8	8.8	1 35.5	15.4	61.2
22	146 33.0	09.1	307 52.6	8.9	1 50.9	15.4	61.1
23	161 33.1	08.2	322 20.5	8.8	2 06.3	15.3	61.1
20 00	176 33.1	S11 07.3	336 48.3	8.9	S 2 21.6	15.3	61.1
01	191 33.2	06.4	351 16.2	8.8	2 36.9	15.3	61.1
02	206 33.3	05.5	5 44.0	8.9	2 52.2	15.3	61.1
03	221 33.3	04.6	20 11.9	8.8	3 07.5	15.3	61.1
04	236 33.4	03.7	34 39.7	8.8	3 22.8	15.2	61.1
05	251 33.5	02.8	49 07.5	8.9	3 38.0	15.2	61.1
06	266 33.5	S11 01.9	63 35.4	8.8	S 3 53.2	15.2	61.1
07	281 33.6	01.1	78 03.2	8.8	4 08.4	15.1	61.1
08	296 33.7	11 00.2	92 31.0	8.8	4 23.5	15.1	61.0
S 09	311 33.7	10 59.3	106 58.8	8.8	4 38.6	15.1	61.0
U 10	326 33.8	58.4	121 26.6	8.8	4 53.7	15.0	61.0
N 11	341 33.8	57.5	135 54.4	8.8	5 08.7	15.0	61.0
D 12	356 33.9	S10 56.6	150 22.2	8.8	S 5 23.7	14.9	61.0
A 13	11 34.0	55.7	164 50.0	8.8	5 38.6	14.9	61.0
Y 14	26 34.0	54.8	179 17.8	8.7	5 53.5	14.9	61.0
15	41 34.1	53.9	193 45.5	8.8	6 08.4	14.8	60.9
16	56 34.2	53.0	208 13.3	8.7	6 23.2	14.7	60.9
17	71 34.3	52.1	222 41.0	8.7	6 37.9	14.8	60.9
18	86 34.3	S10 51.2	237 08.7	8.7	S 6 52.7	14.6	60.9
19	101 34.4	50.3	251 36.4	8.7	7 07.3	14.6	60.9
20	116 34.5	49.4	266 04.1	8.7	7 21.9	14.6	60.9
21	131 34.5	48.5	280 31.8	8.7	7 36.5	14.5	60.8
22	146 34.6	47.6	294 59.5	8.6	7 51.0	14.4	60.8
23	161 34.7	46.7	309 27.1	8.7	S 8 05.4	14.4	60.8
	SD 16.2	d 0.9	SD	16.6		16.7	16.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 18	Moonrise 19	Moonrise 20	Moonrise 21
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 59	07 17	08 33	17 20	19 41	22 03	24 39
N 70	05 59	07 10	08 16	17 28	19 39	21 50	24 08
68	05 58	07 03	08 03	17 35	19 38	21 40	23 46
66	05 58	06 58	07 52	17 40	19 36	21 32	23 29
64	05 58	06 53	07 43	17 45	19 35	21 25	23 15
62	05 57	06 49	07 35	17 49	19 34	21 19	23 04
60	05 57	06 45	07 28	17 52	19 33	21 14	22 54
N 58	05 56	06 42	07 22	17 55	19 32	21 09	22 45
56	05 55	06 39	07 17	17 58	19 32	21 05	22 38
54	05 55	06 36	07 12	18 00	19 31	21 02	22 31
52	05 54	06 33	07 08	18 02	19 30	20 58	22 25
50	05 53	06 31	07 04	18 04	19 30	20 55	22 20
45	05 51	06 25	06 55	18 08	19 29	20 49	22 08
N 40	05 49	06 21	06 48	18 12	19 28	20 44	21 59
35	05 47	06 16	06 42	18 15	19 27	20 39	21 51
30	05 44	06 12	06 37	18 18	19 27	20 35	21 44
20	05 39	06 05	06 27	18 22	19 25	20 28	21 31
N 10	05 32	05 57	06 19	18 26	19 24	20 23	21 21
0	05 25	05 49	06 10	18 30	19 24	20 17	21 11
S 10	05 16	05 41	06 02	18 34	19 23	20 12	21 01
20	05 04	05 31	05 53	18 38	19 22	20 06	20 51
30	04 49	05 18	05 43	18 43	19 21	19 59	20 39
35	04 40	05 11	05 37	18 45	19 20	19 56	20 33
40	04 28	05 02	05 30	18 48	19 20	19 52	20 25
45	04 13	04 51	05 22	18 52	19 19	19 47	20 16
S 50	03 55	04 38	05 13	18 56	19 18	19 41	20 06
52	03 45	04 32	05 08	18 58	19 18	19 38	20 01
54	03 35	04 25	05 03	19 00	19 18	19 36	19 56
56	03 23	04 17	04 58	19 02	19 17	19 33	19 50
58	03 08	04 07	04 52	19 04	19 17	19 29	19 43
S 60	02 51	03 57	04 45	19 07	19 16	19 25	19 36

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 18	Moonset 19	Moonset 20	Moonset 21
°	h m	h m	h m	h m	h m	h m	h m
N 72	15 57	17 12	18 31	07 44	07 18	06 54	06 26
N 70	16 13	17 20	18 31	07 33	07 16	07 00	06 42
68	16 26	17 26	18 31	07 24	07 14	07 05	06 54
66	16 37	17 32	18 31	07 17	07 13	07 09	07 05
64	16 46	17 36	18 32	07 10	07 11	07 12	07 13
62	16 54	17 40	18 32	07 04	07 10	07 15	07 21
60	17 01	17 44	18 32	07 00	07 09	07 18	07 27
N 58	17 06	17 47	18 33	06 55	07 08	07 20	07 33
56	17 12	17 50	18 33	06 51	07 07	07 22	07 38
54	17 16	17 53	18 34	06 48	07 06	07 24	07 43
52	17 21	17 55	18 35	06 45	07 06	07 26	07 47
50	17 25	17 58	18 35	06 42	07 05	07 27	07 51
45	17 33	18 03	18 37	06 35	07 03	07 31	07 59
N 40	17 40	18 08	18 39	06 30	07 02	07 34	08 06
35	17 46	18 12	18 41	06 25	07 01	07 36	08 12
30	17 51	18 16	18 44	06 21	07 00	07 38	08 17
20	18 01	18 23	18 49	06 14	06 58	07 42	08 27
N 10	18 09	18 31	18 55	06 08	06 57	07 46	08 35
0	18 17	18 38	19 03	06 02	06 55	07 49	08 43
S 10	18 25	18 47	19 12	05 55	06 54	07 52	08 50
20	18 34	18 57	19 23	05 49	06 52	07 55	08 58
30	18 44	19 09	19 38	05 41	06 50	07 59	09 08
35	18 50	19 16	19 47	05 37	06 49	08 01	09 13
40	18 57	19 25	19 59	05 32	06 48	08 04	09 19
45	19 04	19 35	20 13	05 26	06 47	08 07	09 27
S 50	19 14	19 48	20 31	05 19	06 45	08 10	09 35
52	19 18	19 55	20 40	05 16	06 44	08 12	09 39
54	19 23	20 02	20 51	05 12	06 43	08 14	09 44
56	19 28	20 09	21 03	05 08	06 42	08 16	09 49
58	19 34	20 18	21 17	05 03	06 41	08 18	09 54
S 60	19 41	20 29	21 34	04 58	06 40	08 20	10 01

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
18	13 58	13 56	12 14	24 43	12 16	15	100
19	13 53	13 51	12 14	00 43	13 10	16	98
20	13 48	13 44	12 14	01 36	14 03	17	93

UT	ARIES	VENUS −4.2		MARS +1.1		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
21 00	150 34.3	219 53.9	S20 37.8	179 38.8	S13 02.6	144 39.7	N 1 19.9	314 12.8	S 4 06.3
01	165 36.8	234 53.2	37.6	194 39.4	01.9	159 41.7	20.1	329 15.4	06.3
02	180 39.2	249 52.6	37.3	209 40.0	01.2	174 43.6	20.4	344 17.9	06.2
03	195 41.7	264 51.9	37.1	224 40.5	13 00.5	189 45.6	20.6	359 20.5	06.2
04	210 44.2	279 51.3	36.8	239 41.1	12 59.8	204 47.6	20.8	14 23.1	06.1
05	225 46.6	294 50.6	36.6	254 41.7	59.1	219 49.5	21.0	29 25.6	06.1
06	240 49.1	309 50.0	S20 36.3	269 42.2	S12 58.4	234 51.5	N 1 21.3	44 28.2	S 4 06.0
07	255 51.5	324 49.3	36.1	284 42.8	57.7	249 53.4	21.5	59 30.7	06.0
08	270 54.0	339 48.7	35.8	299 43.4	57.0	264 55.4	21.7	74 33.3	05.9
M 09	285 56.5	354 48.0	35.6	314 43.9	56.3	279 57.3	21.9	89 35.9	05.9
O 10	300 58.9	9 47.4	35.3	329 44.5	55.6	294 59.3	22.2	104 38.4	05.8
N 11	316 01.4	24 46.7	35.0	344 45.1	55.0	310 01.3	22.4	119 41.0	05.8
D 12	331 03.9	39 46.1	S20 34.8	359 45.6	S12 54.3	325 03.2	N 1 22.6	134 43.6	S 4 05.7
A 13	346 06.3	54 45.4	34.5	14 46.2	53.6	340 05.2	22.8	149 46.1	05.7
Y 14	1 08.8	69 44.8	34.3	29 46.8	52.9	355 07.1	23.1	164 48.7	05.6
15	16 11.3	84 44.1	34.0	44 47.3	52.2	10 09.1	23.3	179 51.2	05.6
16	31 13.7	99 43.5	33.7	59 47.9	51.5	25 11.0	23.5	194 53.8	05.5
17	46 16.2	114 42.8	33.5	74 48.5	50.8	40 13.0	23.7	209 56.4	05.5
18	61 18.6	129 42.2	S20 33.2	89 49.0	S12 50.1	55 14.9	N 1 23.9	224 58.9	S 4 05.4
19	76 21.1	144 41.5	32.9	104 49.6	49.4	70 16.9	24.2	240 01.5	05.4
20	91 23.6	159 40.9	32.7	119 50.2	48.7	85 18.9	24.4	255 04.1	05.3
21	106 26.0	174 40.2	32.4	134 50.7	48.0	100 20.8	24.6	270 06.6	05.3
22	121 28.5	189 39.6	32.1	149 51.3	47.3	115 22.8	24.8	285 09.2	05.2
23	136 31.0	204 39.0	31.9	164 51.9	46.6	130 24.7	25.1	300 11.8	05.2
22 00	151 33.4	219 38.3	S20 31.6	179 52.4	S12 45.9	145 26.7	N 1 25.3	315 14.3	S 4 05.1
01	166 35.9	234 37.7	31.3	194 53.0	45.2	160 28.6	25.5	330 16.9	05.1
02	181 38.4	249 37.0	31.1	209 53.6	44.6	175 30.6	25.7	345 19.4	05.0
03	196 40.8	264 36.4	30.8	224 54.2	43.9	190 32.5	26.0	0 22.0	05.0
04	211 43.3	279 35.7	30.5	239 54.7	43.2	205 34.5	26.2	15 24.6	04.9
05	226 45.8	294 35.1	30.2	254 55.3	42.5	220 36.5	26.4	30 27.1	04.9
06	241 48.2	309 34.4	S20 30.0	269 55.9	S12 41.8	235 38.4	N 1 26.6	45 29.7	S 4 04.8
07	256 50.7	324 33.8	29.7	284 56.4	41.1	250 40.4	26.9	60 32.3	04.8
T 08	271 53.1	339 33.1	29.4	299 57.0	40.4	265 42.3	27.1	75 34.8	04.7
U 09	286 55.6	354 32.5	29.1	314 57.6	39.7	280 44.3	27.3	90 37.4	04.6
E 10	301 58.1	9 31.8	28.8	329 58.2	39.0	295 46.2	27.5	105 40.0	04.6
S 11	317 00.5	24 31.2	28.6	344 58.7	38.3	310 48.2	27.8	120 42.5	04.5
D 12	332 03.0	39 30.5	S20 28.3	359 59.3	S12 37.6	325 50.1	N 1 28.0	135 45.1	S 4 04.5
A 13	347 05.5	54 29.9	28.0	14 59.9	36.9	340 52.1	28.2	150 47.7	04.4
Y 14	2 07.9	69 29.2	27.7	30 00.4	36.2	355 54.0	28.4	165 50.2	04.4
15	17 10.4	84 28.6	27.4	45 01.0	35.5	10 56.0	28.7	180 52.8	04.3
16	32 12.9	99 27.9	27.1	60 01.6	34.8	25 57.9	28.9	195 55.4	04.3
17	47 15.3	114 27.3	26.9	75 02.2	34.1	40 59.9	29.1	210 57.9	04.2
18	62 17.8	129 26.6	S20 26.6	90 02.7	S12 33.4	56 01.9	N 1 29.3	226 00.5	S 4 04.2
19	77 20.3	144 26.0	26.3	105 03.3	32.7	71 03.8	29.6	241 03.1	04.1
20	92 22.7	159 25.3	26.0	120 03.9	32.0	86 05.8	29.8	256 05.6	04.1
21	107 25.2	174 24.7	25.7	135 04.4	31.3	101 07.7	30.0	271 08.2	04.0
22	122 27.6	189 24.0	25.4	150 05.0	30.6	116 09.7	30.2	286 10.8	04.0
23	137 30.1	204 23.4	25.1	165 05.6	29.9	131 11.6	30.5	301 13.3	03.9
23 00	152 32.6	219 22.7	S20 24.8	180 06.2	S12 29.2	146 13.6	N 1 30.7	316 15.9	S 4 03.9
01	167 35.0	234 22.1	24.5	195 06.7	28.5	161 15.5	30.9	331 18.5	03.8
02	182 37.5	249 21.4	24.2	210 07.3	27.8	176 17.5	31.1	346 21.0	03.8
03	197 40.0	264 20.8	23.9	225 07.9	27.1	191 19.4	31.4	1 23.6	03.7
04	212 42.4	279 20.2	23.6	240 08.5	26.4	206 21.4	31.6	16 26.2	03.6
05	227 44.9	294 19.5	23.3	255 09.0	25.7	221 23.3	31.8	31 28.7	03.6
06	242 47.4	309 18.9	S20 23.0	270 09.6	S12 25.0	236 25.3	N 1 32.0	46 31.3	S 4 03.5
W 07	257 49.8	324 18.2	22.7	285 10.2	24.3	251 27.2	32.3	61 33.9	03.5
E 08	272 52.3	339 17.6	22.4	300 10.8	23.6	266 29.2	32.5	76 36.4	03.4
D 09	287 54.7	354 16.9	22.1	315 11.3	22.9	281 31.1	32.7	91 39.0	03.4
N 10	302 57.2	9 16.3	21.8	330 11.9	22.2	296 33.1	32.9	106 41.6	03.3
E 11	317 59.7	24 15.6	21.5	345 12.5	21.5	311 35.1	33.2	121 44.2	03.3
S 12	333 02.1	39 15.0	S20 21.2	0 13.0	S12 20.8	326 37.0	N 1 33.4	136 46.7	S 4 03.2
D 13	348 04.6	54 14.3	20.9	15 13.6	20.1	341 39.0	33.6	151 49.3	03.2
A 14	3 07.1	69 13.7	20.6	30 14.2	19.4	356 40.9	33.8	166 51.9	03.1
Y 15	18 09.5	84 13.0	20.3	45 14.8	18.7	11 42.9	34.1	181 54.4	03.1
16	33 12.0	99 12.4	20.0	60 15.4	18.0	26 44.8	34.3	196 57.0	03.0
17	48 14.5	114 11.7	19.7	75 15.9	17.3	41 46.8	34.5	211 59.6	03.0
18	63 16.9	129 11.1	S20 19.4	90 16.5	S12 16.6	56 48.7	N 1 34.7	227 02.1	S 4 02.9
19	78 19.4	144 10.4	19.0	105 17.1	15.9	71 50.7	35.0	242 04.7	02.8
20	93 21.9	159 09.8	18.7	120 17.7	15.2	86 52.6	35.2	257 07.3	02.8
21	108 24.3	174 09.1	18.4	135 18.2	14.5	101 54.6	35.4	272 09.9	02.7
22	123 26.8	189 08.5	18.1	150 18.8	13.8	116 56.5	35.6	287 12.4	02.7
23	138 29.2	204 07.9	17.8	165 19.4	13.1	131 58.5	35.9	302 15.0	02.6
Mer. Pass.	h m 13 51.5	v −0.6	d 0.3	v 0.6	d 0.7	v 2.0	d 0.2	v 2.6	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.8
Achernar	335 28.2	S57 11.0
Acrux	173 10.7	S63 09.7
Adhara	255 13.6	S28 59.5
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.6	N55 53.6
Alkaid	152 59.8	N49 15.1
Al Na'ir	27 46.2	S46 54.4
Alnilam	275 47.9	S 1 11.8
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.3	N26 40.3
Alpheratz	357 45.5	N29 09.2
Altair	62 10.1	N 8 53.8
Ankaa	353 17.6	S42 14.8
Antares	112 28.3	S26 27.4
Arcturus	145 57.0	N19 07.2
Atria	107 31.8	S69 02.6
Avior	234 18.2	S59 33.0
Bellatrix	278 33.7	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.6	S52 42.4
Capella	280 36.7	N46 00.7
Deneb	49 33.1	N45 19.1
Denebola	182 35.0	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.9	N61 41.2
Elnath	278 14.6	N28 37.0
Eltanin	90 47.1	N51 29.0
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.4	S57 10.6
Gienah	175 53.7	S17 36.4
Hadar	148 50.0	S60 25.5
Hamal	328 02.8	N23 31.0
Kaus Aust.	83 46.2	S34 22.6
Kochab	137 19.4	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.4	S36 25.5
Miaplacidus	221 39.3	S69 46.0
Mirfak	308 42.8	N49 54.2
Nunki	76 00.6	S26 16.9
Peacock	53 22.3	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.1	N12 33.0
Regulus	207 44.9	N11 54.5
Rigel	281 13.5	S 8 11.5
Rigil Kent.	139 53.8	S60 52.7
Sabik	102 14.5	S15 44.3
Schedar	349 43.0	N56 36.1
Shaula	96 24.3	S37 06.6
Sirius	258 34.9	S16 44.1
Spica	158 32.8	S11 13.3
Suhail	222 53.3	S43 28.9
Vega	80 40.3	N38 47.4
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	68 04.9	9 22
Mars	28 19.0	12 00
Jupiter	353 53.2	14 16
Saturn	163 40.9	2 59

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
21 00	176 34.7	S10 45.8	323 54.8	8.6	S 8 19.8	14.3	60.8
01	191 34.8	44.9	338 22.4	8.6	8 34.1	14.2	60.8
02	206 34.9	44.0	352 50.0	8.6	8 48.3	14.2	60.7
03	221 34.9	. . 43.1	7 17.6	8.5	9 02.5	14.2	60.7
04	236 35.0	42.2	21 45.1	8.6	9 16.7	14.0	60.7
05	251 35.1	41.3	36 12.7	8.5	9 30.7	14.0	60.7
06	266 35.2	S10 40.4	50 40.2	8.5	S 9 44.7	13.9	60.6
07	281 35.2	39.5	65 07.7	8.5	9 58.6	13.8	60.6
08	296 35.3	38.6	79 35.2	8.4	10 12.4	13.8	60.6
M 09	311 35.4	. . 37.7	94 02.6	8.5	10 26.2	13.7	60.6
O 10	326 35.4	36.8	108 30.1	8.4	10 39.9	13.6	60.5
N 11	341 35.5	35.9	122 57.5	8.4	10 53.5	13.5	60.5
D 12	356 35.6	S10 35.0	137 24.9	8.4	S11 07.0	13.5	60.5
A 13	11 35.7	34.1	151 52.3	8.3	11 20.5	13.4	60.5
Y 14	26 35.7	33.2	166 19.6	8.4	11 33.9	13.3	60.4
15	41 35.8	. . 32.2	180 47.0	8.3	11 47.2	13.2	60.4
16	56 35.9	31.3	195 14.3	8.2	12 00.4	13.1	60.4
17	71 36.0	30.4	209 41.5	8.3	12 13.5	13.0	60.4
18	86 36.0	S10 29.5	224 08.8	8.2	S12 26.5	12.9	60.3
19	101 36.1	28.6	238 36.0	8.2	12 39.4	12.9	60.3
20	116 36.2	27.7	253 03.2	8.2	12 52.3	12.8	60.3
21	131 36.3	. . 26.8	267 30.4	8.2	13 05.1	12.6	60.3
22	146 36.3	25.9	281 57.6	8.1	13 17.7	12.6	60.2
23	161 36.4	25.0	296 24.7	8.1	13 30.3	12.5	60.2
22 00	176 36.5	S10 24.1	310 51.8	8.1	S13 42.8	12.4	60.2
01	191 36.6	23.2	325 18.9	8.1	13 55.2	12.2	60.1
02	206 36.6	22.3	339 46.0	8.0	14 07.4	12.2	60.1
03	221 36.7	. . 21.4	354 13.0	8.0	14 19.6	12.1	60.1
04	236 36.8	20.5	8 40.0	8.0	14 31.7	12.0	60.1
05	251 36.9	19.6	23 07.0	7.9	14 43.7	11.9	60.0
06	266 36.9	S10 18.6	37 33.9	7.9	S14 55.6	11.7	60.0
07	281 37.0	17.7	52 00.8	7.9	15 07.3	11.7	60.0
T 08	296 37.1	16.8	66 27.7	7.9	15 19.0	11.6	59.9
U 09	311 37.2	. . 15.9	80 54.6	7.8	15 30.6	11.4	59.9
E 10	326 37.3	15.0	95 21.4	7.8	15 42.0	11.4	59.9
S 11	341 37.3	14.1	109 48.2	7.8	15 53.4	11.2	59.8
D 12	356 37.4	S10 13.2	124 15.0	7.8	S16 04.6	11.1	59.8
A 13	11 37.5	12.3	138 41.8	7.7	16 15.7	11.0	59.8
Y 14	26 37.6	11.4	153 08.5	7.7	16 26.7	10.9	59.7
15	41 37.7	. . 10.5	167 35.2	7.7	16 37.6	10.8	59.7
16	56 37.7	09.5	182 01.9	7.6	16 48.4	10.7	59.7
17	71 37.8	08.6	196 28.5	7.7	16 59.1	10.5	59.7
18	86 37.9	S10 07.7	210 55.2	7.6	S17 09.6	10.4	59.6
19	101 38.0	06.8	225 21.8	7.5	17 20.0	10.4	59.6
20	116 38.1	05.9	239 48.3	7.6	17 30.4	10.2	59.6
21	131 38.1	. . 05.0	254 14.9	7.5	17 40.6	10.0	59.5
22	146 38.2	04.1	268 41.4	7.5	17 50.6	10.0	59.5
23	161 38.3	03.2	283 07.9	7.5	18 00.6	9.8	59.5
23 00	176 38.4	S10 02.2	297 34.4	7.4	S18 10.4	9.7	59.4
01	191 38.5	01.3	312 00.8	7.5	18 20.1	9.6	59.4
02	206 38.6	10 00.4	326 27.3	7.4	18 29.7	9.4	59.4
03	221 38.6	9 59.5	340 53.7	7.3	18 39.1	9.4	59.3
04	236 38.7	58.6	355 20.0	7.4	18 48.5	9.2	59.3
05	251 38.8	57.7	9 46.4	7.3	18 57.7	9.0	59.3
06	266 38.9	S 9 56.7	24 12.7	7.3	S19 06.7	9.0	59.2
W 07	281 39.0	55.8	38 39.0	7.3	19 15.7	8.8	59.2
E 08	296 39.1	54.9	53 05.3	7.3	19 24.5	8.7	59.1
D 09	311 39.1	. . 54.0	67 31.6	7.2	19 33.2	8.5	59.1
N 10	326 39.2	53.1	81 57.8	7.3	19 41.7	8.5	59.1
E 11	341 39.3	52.2	96 24.1	7.2	19 50.2	8.3	59.0
S 12	356 39.4	S 9 51.2	110 50.3	7.2	S19 58.5	8.1	59.0
D 13	11 39.5	50.3	125 16.5	7.1	20 06.6	8.0	59.0
A 14	26 39.6	49.4	139 42.6	7.2	20 14.6	7.9	58.9
Y 15	41 39.7	. . 48.5	154 08.8	7.1	20 22.5	7.8	58.9
16	56 39.7	47.6	168 34.9	7.2	20 30.3	7.6	58.9
17	71 39.8	46.7	183 01.1	7.1	20 37.9	7.5	58.8
18	86 39.9	S 9 45.7	197 27.2	7.1	S20 45.4	7.3	58.8
19	101 40.0	44.8	211 53.3	7.0	20 52.7	7.2	58.8
20	116 40.1	43.9	226 19.3	7.1	20 59.9	7.1	58.7
21	131 40.2	. . 43.0	240 45.4	7.0	21 07.0	6.9	58.7
22	146 40.3	42.1	255 11.4	7.1	21 13.9	6.8	58.7
23	161 40.4	41.1	269 37.5	7.0	S21 20.7	6.7	58.6
	SD 16.2	d 0.9	SD	16.5		16.3		16.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 21	Moonrise 22	Moonrise 23	Moonrise 24
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 45	07 03	08 16	24 39	00 39	▬	▬
N 70	05 46	06 57	08 02	24 08	00 08	02 53	▬
68	05 47	06 52	07 50	23 46	26 01	02 01	▬
66	05 48	06 47	07 41	23 29	25 29	01 29	03 32
64	05 49	06 43	07 33	23 15	25 06	01 06	02 52
62	05 49	06 40	07 26	23 04	24 47	00 47	02 25
60	05 49	06 37	07 20	22 54	24 32	00 32	02 04
N 58	05 49	06 34	07 14	22 45	24 19	00 19	01 47
56	05 49	06 32	07 10	22 38	24 08	00 08	01 33
54	05 48	06 29	07 06	22 31	23 58	25 20	01 20
52	05 48	06 27	07 02	22 25	23 50	25 09	01 09
50	05 48	06 25	06 58	22 20	23 42	24 59	00 59
45	05 47	06 21	06 51	22 08	23 26	24 39	00 39
N 40	05 45	06 17	06 44	21 59	23 12	24 23	00 23
35	05 44	06 13	06 39	21 51	23 01	24 09	00 09
30	05 42	06 09	06 34	21 44	22 51	23 57	24 59
20	05 37	06 03	06 25	21 31	22 34	23 36	24 37
N 10	05 31	05 56	06 17	21 21	22 20	23 19	24 17
0	05 25	05 49	06 10	21 11	22 06	23 02	23 59
S 10	05 16	05 41	06 03	21 01	21 53	22 46	23 41
20	05 06	05 32	05 55	20 51	21 38	22 28	23 21
30	04 52	05 21	05 45	20 39	21 22	22 08	22 59
35	04 43	05 14	05 40	20 33	21 13	21 57	22 46
40	04 32	05 06	05 34	20 25	21 02	21 43	22 31
45	04 18	04 56	05 27	20 16	20 49	21 28	22 13
S 50	04 01	04 44	05 18	20 06	20 34	21 09	21 51
52	03 53	04 38	05 14	20 01	20 27	21 00	21 40
54	03 43	04 31	05 09	19 56	20 19	20 50	21 29
56	03 32	04 24	05 05	19 50	20 11	20 38	21 15
58	03 19	04 16	04 59	19 43	20 01	20 25	20 59
S 60	03 03	04 06	04 53	19 36	19 50	20 10	20 40

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 21	Moonset 22	Moonset 23	Moonset 24
°	h m	h m	h m	h m	h m	h m	h m
N 72	16 13	17 26	18 44	06 26	05 46	▬	▬
N 70	16 27	17 32	18 43	06 42	06 18	05 30	▬
68	16 38	17 37	18 42	06 54	06 42	06 23	▬
66	16 48	17 41	18 41	07 05	07 00	06 56	06 51
64	16 56	17 45	18 40	07 13	07 16	07 20	07 31
62	17 02	17 48	18 40	07 21	07 28	07 40	07 59
60	17 08	17 51	18 39	07 27	07 39	07 56	08 20
N 58	17 14	17 54	18 39	07 33	07 49	08 09	08 38
56	17 18	17 56	18 39	07 38	07 57	08 21	08 52
54	17 22	17 59	18 40	07 43	08 04	08 31	09 05
52	17 26	18 01	18 40	07 47	08 11	08 40	09 16
50	17 30	18 03	18 40	07 51	08 17	08 48	09 26
45	17 37	18 07	18 41	07 59	08 30	09 06	09 48
N 40	17 43	18 11	18 42	08 06	08 41	09 20	10 05
35	17 49	18 15	18 44	08 12	08 50	09 32	10 19
30	17 54	18 18	18 46	08 17	08 59	09 43	10 32
20	18 02	18 24	18 50	08 27	09 13	10 02	10 53
N 10	18 10	18 31	18 56	08 35	09 25	10 18	11 12
0	18 17	18 38	19 02	08 43	09 37	10 33	11 29
S 10	18 24	18 45	19 10	08 50	09 49	10 48	11 47
20	18 32	18 54	19 21	08 58	10 01	11 04	12 05
30	18 41	19 06	19 35	09 08	10 16	11 23	12 27
35	18 46	19 12	19 43	09 13	10 24	11 34	12 40
40	18 52	19 20	19 54	09 19	10 34	11 46	12 54
45	18 59	19 30	20 07	09 27	10 45	12 01	13 12
S 50	19 08	19 42	20 24	09 35	10 59	12 19	13 33
52	19 12	19 48	20 33	09 39	11 05	12 28	13 44
54	19 16	19 54	20 42	09 44	11 13	12 37	13 55
56	19 21	20 01	20 53	09 49	11 21	12 48	14 08
58	19 26	20 10	21 06	09 54	11 30	13 01	14 24
S 60	19 33	20 19	21 21	10 01	11 40	13 16	14 42

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
21	13 41	13 38	12 14	02 30	14 57	18	86
22	13 34	13 30	12 14	03 24	15 52	19	76
23	13 27	13 23	12 13	04 19	16 47	20	66

UT	ARIES	VENUS −4.1		MARS +1.1		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
24 00	153 31.7	219 07.2	S20 17.5	180 20.0	S12 12.3	147 00.4	N 1 36.1	317 17.6	S 4 02.6
01	168 34.2	234 06.6	17.1	195 20.5	11.6	162 02.4	36.3	332 20.1	02.5
02	183 36.6	249 05.9	16.8	210 21.1	10.9	177 04.3	36.5	347 22.7	02.5
03	198 39.1	264 05.3	16.5	225 21.7	10.2	192 06.3	36.8	2 25.3	02.4
04	213 41.6	279 04.6	16.2	240 22.3	09.5	207 08.2	37.0	17 27.9	02.4
05	228 44.0	294 04.0	15.9	255 22.9	08.8	222 10.2	37.2	32 30.4	02.3
06	243 46.5	309 03.3	S20 15.5	270 23.4	S12 08.1	237 12.1	N 1 37.4	47 33.0	S 4 02.2
07	258 49.0	324 02.7	15.2	285 24.0	07.4	252 14.1	37.7	62 35.6	02.2
T 08	273 51.4	339 02.0	14.9	300 24.6	06.7	267 16.0	37.9	77 38.1	02.1
H 09	288 53.9	354 01.4	14.6	315 25.2	06.0	282 18.0	38.1	92 40.7	02.1
U 10	303 56.4	9 00.7	14.2	330 25.7	05.3	297 19.9	38.3	107 43.3	02.0
R 11	318 58.8	24 00.1	13.9	345 26.3	04.6	312 21.9	38.6	122 45.9	02.0
S 12	334 01.3	38 59.4	S20 13.6	0 26.9	S12 03.9	327 23.8	N 1 38.8	137 48.4	S 4 01.9
D 13	349 03.7	53 58.8	13.2	15 27.5	03.2	342 25.8	39.0	152 51.0	01.9
A 14	4 06.2	68 58.2	12.9	30 28.1	02.5	357 27.7	39.2	167 53.6	01.8
Y 15	19 08.7	83 57.5	12.6	45 28.6	01.8	12 29.7	39.5	182 56.2	01.8
16	34 11.1	98 56.9	12.2	60 29.2	01.0	27 31.6	39.7	197 58.7	01.7
17	49 13.6	113 56.2	11.9	75 29.8	12 00.3	42 33.6	39.9	213 01.3	01.6
18	64 16.1	128 55.6	S20 11.6	90 30.4	S11 59.6	57 35.5	N 1 40.1	228 03.9	S 4 01.6
19	79 18.5	143 54.9	11.2	105 31.0	58.9	72 37.5	40.4	243 06.4	01.5
20	94 21.0	158 54.3	10.9	120 31.5	58.2	87 39.4	40.6	258 09.0	01.5
21	109 23.5	173 53.6	10.6	135 32.1	57.5	102 41.4	40.8	273 11.6	01.4
22	124 25.9	188 53.0	10.2	150 32.7	56.8	117 43.3	41.1	288 14.2	01.4
23	139 28.4	203 52.3	09.9	165 33.3	56.1	132 45.3	41.3	303 16.7	01.3
25 00	154 30.9	218 51.7	S20 09.5	180 33.9	S11 55.4	147 47.2	N 1 41.5	318 19.3	S 4 01.3
01	169 33.3	233 51.0	09.2	195 34.4	54.7	162 49.2	41.7	333 21.9	01.2
02	184 35.8	248 50.4	08.8	210 35.0	54.0	177 51.1	42.0	348 24.5	01.1
03	199 38.2	263 49.8	08.5	225 35.6	53.2	192 53.1	42.2	3 27.0	01.1
04	214 40.7	278 49.1	08.2	240 36.2	52.5	207 55.0	42.4	18 29.6	01.0
05	229 43.2	293 48.5	07.8	255 36.8	51.8	222 56.9	42.6	33 32.2	01.0
06	244 45.6	308 47.8	S20 07.5	270 37.4	S11 51.1	237 58.9	N 1 42.9	48 34.8	S 4 00.9
07	259 48.1	323 47.2	07.1	285 37.9	50.4	253 00.8	43.1	63 37.3	00.9
08	274 50.6	338 46.5	06.8	300 38.5	49.7	268 02.8	43.3	78 39.9	00.8
F 09	289 53.0	353 45.9	06.4	315 39.1	49.0	283 04.7	43.5	93 42.5	00.8
R 10	304 55.5	8 45.2	06.1	330 39.7	48.3	298 06.7	43.8	108 45.1	00.7
I 11	319 58.0	23 44.6	05.7	345 40.3	47.6	313 08.6	44.0	123 47.6	00.6
D 12	335 00.4	38 44.0	S20 05.4	0 40.8	S11 46.8	328 10.6	N 1 44.2	138 50.2	S 4 00.6
A 13	350 02.9	53 43.3	05.0	15 41.4	46.1	343 12.5	44.4	153 52.8	00.5
Y 14	5 05.3	68 42.7	04.6	30 42.0	45.4	358 14.5	44.7	168 55.4	00.5
15	20 07.8	83 42.0	04.3	45 42.6	44.7	13 16.4	44.9	183 57.9	00.4
16	35 10.3	98 41.4	03.9	60 43.2	44.0	28 18.4	45.1	199 00.5	00.4
17	50 12.7	113 40.7	03.6	75 43.8	43.3	43 20.3	45.4	214 03.1	00.3
18	65 15.2	128 40.1	S20 03.2	90 44.4	S11 42.6	58 22.3	N 1 45.6	229 05.7	S 4 00.3
19	80 17.7	143 39.4	02.8	105 44.9	41.8	73 24.2	45.8	244 08.3	00.2
20	95 20.1	158 38.8	02.5	120 45.5	41.1	88 26.2	46.0	259 10.8	00.1
21	110 22.6	173 38.2	02.1	135 46.1	40.4	103 28.1	46.3	274 13.4	00.1
22	125 25.1	188 37.5	01.8	150 46.7	39.7	118 30.1	46.5	289 16.0	00.0
23	140 27.5	203 36.9	01.4	165 47.3	39.0	133 32.0	46.7	304 18.6	4 00.0
26 00	155 30.0	218 36.2	S20 01.0	180 47.9	S11 38.3	148 33.9	N 1 46.9	319 21.1	S 3 59.9
01	170 32.5	233 35.6	00.7	195 48.4	37.6	163 35.9	47.2	334 23.7	59.9
02	185 34.9	248 34.9	20 00.3	210 49.0	36.9	178 37.8	47.4	349 26.3	59.8
03	200 37.4	263 34.3	19 59.9	225 49.6	36.1	193 39.8	47.6	4 28.9	59.7
04	215 39.8	278 33.7	59.6	240 50.2	35.4	208 41.7	47.8	19 31.5	59.7
05	230 42.3	293 33.0	59.2	255 50.8	34.7	223 43.7	48.1	34 34.0	59.6
06	245 44.8	308 32.4	S19 58.8	270 51.4	S11 34.0	238 45.6	N 1 48.3	49 36.6	S 3 59.6
07	260 47.2	323 31.7	58.4	285 52.0	33.3	253 47.6	48.5	64 39.2	59.5
S 08	275 49.7	338 31.1	58.1	300 52.5	32.6	268 49.5	48.8	79 41.8	59.5
A 09	290 52.2	353 30.4	57.7	315 53.1	31.8	283 51.5	49.0	94 44.3	59.4
T 10	305 54.6	8 29.8	57.3	330 53.7	31.1	298 53.4	49.2	109 46.9	59.3
U 11	320 57.1	23 29.2	56.9	345 54.3	30.4	313 55.3	49.4	124 49.5	59.3
R 12	335 59.6	38 28.5	S19 56.6	0 54.9	S11 29.7	328 57.3	N 1 49.7	139 52.1	S 3 59.2
D 13	351 02.0	53 27.9	56.2	15 55.5	29.0	343 59.2	49.9	154 54.7	59.2
A 14	6 04.5	68 27.2	55.8	30 56.1	28.3	359 01.2	50.1	169 57.2	59.1
Y 15	21 07.0	83 26.6	55.4	45 56.7	27.5	14 03.1	50.3	184 59.8	59.1
16	36 09.4	98 25.9	55.0	60 57.2	26.8	29 05.1	50.6	200 02.4	59.0
17	51 11.9	113 25.3	54.7	75 57.8	26.1	44 07.0	50.8	215 05.0	58.9
18	66 14.3	128 24.7	S19 54.3	90 58.4	S11 25.4	59 09.0	N 1 51.0	230 07.6	S 3 58.9
19	81 16.8	143 24.0	53.9	105 59.0	24.7	74 10.9	51.3	245 10.1	58.8
20	96 19.3	158 23.4	53.5	120 59.6	24.0	89 12.9	51.5	260 12.7	58.8
21	111 21.7	173 22.7	53.1	136 00.2	23.2	104 14.8	51.7	275 15.3	58.7
22	126 24.2	188 22.1	52.7	151 00.8	22.5	119 16.7	51.9	290 17.9	58.7
23	141 26.7	203 21.5	52.4	166 01.4	21.8	134 18.7	52.2	305 20.5	58.6
	h m								
Mer. Pass.	13 39.7	v −0.6	d 0.4	v 0.6	d 0.7	v 1.9	d 0.2	v 2.6	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.8
Achernar	335 28.2	S57 11.0
Acrux	173 10.7	S63 09.7
Adhara	255 13.6	S28 59.5
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.6	N55 53.6
Alkaid	152 59.8	N49 15.1
Al Na'ir	27 46.2	S46 54.4
Alnilam	275 47.9	S 1 11.8
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.3	N26 40.3
Alpheratz	357 45.5	N29 09.2
Altair	62 10.1	N 8 53.8
Ankaa	353 17.6	S42 14.8
Antares	112 28.3	S26 27.4
Arcturus	145 57.0	N19 07.2
Atria	107 31.7	S69 02.6
Avior	234 18.2	S59 33.0
Bellatrix	278 33.7	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.6	S52 42.4
Capella	280 36.8	N46 00.7
Deneb	49 33.1	N45 19.1
Denebola	182 35.0	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.9	N61 41.2
Elnath	278 14.6	N28 37.0
Eltanin	90 47.1	N51 29.0
Enif	33 49.1	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.3	S57 10.6
Gienah	175 53.7	S17 36.4
Hadar	148 50.0	S60 25.5
Hamal	328 02.8	N23 31.0
Kaus Aust.	83 46.2	S34 22.6
Kochab	137 19.3	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.3	S36 25.5
Miaplacidus	221 39.3	S69 46.0
Mirfak	308 42.9	N49 54.2
Nunki	76 00.5	S26 16.9
Peacock	53 22.2	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.1	N12 33.0
Regulus	207 44.9	N11 54.5
Rigel	281 13.5	S 8 11.5
Rigil Kent.	139 53.8	S60 52.7
Sabik	102 14.5	S15 44.3
Schedar	349 43.0	N56 36.1
Shaula	96 24.3	S37 06.6
Sirius	258 35.0	S16 44.1
Spica	158 32.8	S11 13.3
Suhail	222 53.3	S43 28.9
Vega	80 40.3	N38 47.4
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	64 20.8	9 25
Mars	26 03.0	11 57
Jupiter	353 16.4	14 07
Saturn	163 48.5	2 46

UT	SUN			MOON					
	GHA		Dec	GHA	v	Dec	d	HP	
d h	° ′		° ′	° ′	′	° ′	′	′	
24 00	176 40.4	S	9 40.2	284 03.5	7.0	S21 27.4	6.5	58.6	
01	191 40.5		39.3	298 29.5	7.0	21 33.9	6.4	58.6	
02	206 40.6		38.4	312 55.5	7.0	21 40.3	6.2	58.5	
03	221 40.7	. .	37.5	327 21.5	7.0	21 46.5	6.1	58.5	
04	236 40.8		36.5	341 47.5	7.0	21 52.6	5.9	58.5	
05	251 40.9	.	35.6	356 13.5	7.0	21 58.5	5.9	58.4	
06	266 41.0	S	9 34.7	10 39.5	7.0	S22 04.4	5.6	58.4	
07	281 41.1		33.8	25 05.5	7.0	22 10.0	5.6	58.3	
T 08	296 41.2		32.9	39 31.5	6.9	22 15.6	5.3	58.3	
H 09	311 41.3	. .	31.9	53 57.4	7.0	22 20.9	5.3	58.3	
U 10	326 41.3		31.0	68 23.4	7.0	22 26.2	5.1	58.2	
R 11	341 41.4		30.1	82 49.4	6.9	22 31.3	4.9	58.2	
S 12	356 41.5	S	9 29.2	97 15.3	7.0	S22 36.2	4.8	58.2	
D 13	11 41.6		28.2	111 41.3	7.0	22 41.0	4.7	58.1	
A 14	26 41.7		27.3	126 07.3	6.9	22 45.7	4.5	58.1	
Y 15	41 41.8	. .	26.4	140 33.2	7.0	22 50.2	4.4	58.1	
16	56 41.9		25.5	154 59.2	7.0	22 54.6	4.2	58.0	
17	71 42.0		24.5	169 25.2	7.0	22 58.8	4.1	58.0	
18	86 42.1	S	9 23.6	183 51.2	7.0	S23 02.9	4.0	58.0	
19	101 42.2		22.7	198 17.2	7.0	23 06.9	3.8	57.9	
20	116 42.3		21.8	212 43.2	7.0	23 10.7	3.6	57.9	
21	131 42.4	. .	20.8	227 09.2	7.0	23 14.3	3.6	57.9	
22	146 42.5		19.9	241 35.2	7.1	23 17.9	3.3	57.8	
23	161 42.6		19.0	256 01.3	7.0	23 21.2	3.3	57.8	
25 00	176 42.6	S	9 18.1	270 27.3	7.1	S23 24.5	3.0	57.8	
01	191 42.7		17.1	284 53.4	7.1	23 27.5	3.0	57.7	
02	206 42.8		16.2	299 19.5	7.1	23 30.5	2.8	57.7	
03	221 42.9	. .	15.3	313 45.6	7.1	23 33.3	2.6	57.7	
04	236 43.0		14.4	328 11.7	7.1	23 35.9	2.5	57.6	
05	251 43.1		13.4	342 37.8	7.1	23 38.4	2.4	57.6	
06	266 43.2	S	9 12.5	357 03.9	7.2	S23 40.8	2.2	57.6	
07	281 43.3		11.6	11 30.1	7.2	23 43.0	2.1	57.5	
08	296 43.4		10.6	25 56.3	7.2	23 45.1	1.9	57.5	
F 09	311 43.5	. .	09.7	40 22.5	7.3	23 47.0	1.8	57.5	
R 10	326 43.6		08.8	54 48.8	7.2	23 48.8	1.6	57.4	
I 11	341 43.7		07.9	69 15.0	7.3	23 50.4	1.5	57.4	
D 12	356 43.8	S	9 06.9	83 41.3	7.3	S23 51.9	1.4	57.4	
A 13	11 43.9		06.0	98 07.6	7.4	23 53.3	1.2	57.3	
Y 14	26 44.0		05.1	112 34.0	7.4	23 54.5	1.1	57.3	
15	41 44.1	. .	04.1	127 00.4	7.4	23 55.6	0.9	57.3	
16	56 44.2		03.2	141 26.8	7.4	23 56.5	0.8	57.2	
17	71 44.3		02.3	155 53.2	7.5	23 57.3	0.7	57.2	
18	86 44.4	S	9 01.3	170 19.7	7.5	S23 58.0	0.5	57.2	
19	101 44.5		9 00.4	184 46.2	7.5	23 58.5	0.4	57.1	
20	116 44.6		8 59.5	199 12.7	7.6	23 58.9	0.2	57.1	
21	131 44.7	. .	58.6	213 39.3	7.6	23 59.1	0.1	57.1	
22	146 44.8		57.6	228 05.9	7.7	23 59.2	0.1	57.0	
23	161 44.9		56.7	242 32.6	7.7	23 59.1	0.1	57.0	
26 00	176 45.0	S	8 55.8	256 59.3	7.7	S23 59.0	0.4	57.0	
01	191 45.1		54.8	271 26.0	7.8	23 58.6	0.4	56.9	
02	206 45.2		53.9	285 52.8	7.8	23 58.2	0.6	56.9	
03	221 45.3	. .	53.0	300 19.6	7.8	23 57.6	0.7	56.9	
04	236 45.4		52.0	314 46.4	7.9	23 56.9	0.9	56.8	
05	251 45.5		51.1	329 13.3	8.0	23 56.0	1.0	56.8	
06	266 45.6	S	8 50.2	343 40.3	8.0	S23 55.0	1.1	56.8	
07	281 45.7		49.2	358 07.3	8.0	23 53.9	1.3	56.8	
S 08	296 45.8		48.3	12 34.3	8.1	23 52.6	1.4	56.7	
A 09	311 45.9	. .	47.4	27 01.4	8.2	23 51.2	1.5	56.7	
T 10	326 46.0		46.4	41 28.6	8.1	23 49.7	1.7	56.7	
U 11	341 46.1		45.5	55 55.7	8.3	23 48.0	1.8	56.6	
R 12	356 46.2	S	8 44.6	70 23.0	8.3	S23 46.2	1.9	56.6	
D 13	11 46.3		43.6	84 50.3	8.3	23 44.3	2.1	56.6	
A 14	26 46.4		42.7	99 17.6	8.4	23 42.2	2.2	56.5	
Y 15	41 46.5	. .	41.8	113 45.0	8.5	23 40.0	2.3	56.5	
16	56 46.6		40.8	128 12.5	8.5	23 37.7	2.5	56.5	
17	71 46.7		39.9	142 40.0	8.5	23 35.2	2.5	56.5	
18	86 46.8	S	8 38.9	157 07.5	8.6	S23 32.7	2.7	56.4	
19	101 46.9		38.0	171 35.1	8.7	23 30.0	2.9	56.4	
20	116 47.1		37.1	186 02.8	8.7	23 27.1	2.9	56.4	
21	131 47.2	. .	36.1	200 30.5	8.8	23 24.2	3.1	56.3	
22	146 47.3		35.2	214 58.3	8.9	23 21.1	3.2	56.3	
23	161 47.4		34.3	229 26.2	8.9	S23 17.9	3.3	56.3	
	SD 16.2		d 0.9	SD	15.8	15.6		15.4	

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 24	Moonrise 25	Moonrise 26	Moonrise 27
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 31	06 49	08 00	▬	▬	▬	▬
N 70	05 34	06 44	07 48	▬	▬	▬	▬
68	05 36	06 40	07 38	▬	▬	▬	▬
66	05 38	06 37	07 29	03 32	05 39	▬	06 46
64	05 39	06 34	07 22	02 52	04 26	05 29	05 59
62	05 40	06 31	07 16	02 25	03 50	04 51	05 28
60	05 41	06 29	07 11	02 04	03 24	04 25	05 05
N 58	05 41	06 27	07 07	01 47	03 04	04 04	04 46
56	05 42	06 25	07 02	01 33	02 47	03 46	04 31
54	05 42	06 23	06 59	01 20	02 32	03 32	04 17
52	05 42	06 21	06 55	01 09	02 20	03 19	04 06
50	05 42	06 20	06 52	00 59	02 09	03 08	03 55
45	05 42	06 16	06 46	00 39	01 46	02 45	03 33
N 40	05 41	06 13	06 40	00 23	01 28	02 26	03 16
35	05 40	06 10	06 35	00 09	01 12	02 10	03 01
30	05 39	06 07	06 31	24 59	00 59	01 56	02 48
20	05 35	06 01	06 23	24 37	00 37	01 33	02 26
N 10	05 30	05 55	06 16	24 17	00 17	01 13	02 07
0	05 24	05 49	06 10	23 59	24 55	00 55	01 49
S 10	05 17	05 42	06 03	23 41	24 36	00 36	01 31
20	05 07	05 34	05 56	23 21	24 16	00 16	01 12
30	04 54	05 23	05 48	22 59	23 53	24 49	00 49
35	04 46	05 17	05 43	22 46	23 39	24 36	00 36
40	04 36	05 09	05 37	22 31	23 24	24 21	00 21
45	04 23	05 00	05 31	22 13	23 05	24 04	00 04
S 50	04 07	04 49	05 23	21 51	22 42	23 41	24 46
52	04 00	04 44	05 20	21 40	22 31	23 31	24 37
54	03 51	04 38	05 16	21 29	22 18	23 19	24 27
56	03 40	04 31	05 11	21 15	22 04	23 05	24 15
58	03 29	04 24	05 06	20 59	21 47	22 49	24 01
S 60	03 14	04 15	05 01	20 40	21 26	22 29	23 45

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 24	Moonset 25	Moonset 26	Moonset 27
°	h m	h m	h m	h m	h m	h m	h m
N 72	16 28	17 39	18 58	▬	▬	▬	▬
N 70	16 40	17 44	18 54	▬	▬	▬	▬
68	16 50	17 48	18 52	▬	▬	▬	▬
66	16 58	17 51	18 50	06 51	06 42	▬	09 23
64	17 05	17 54	18 49	07 31	07 55	08 48	10 10
62	17 11	17 56	18 48	07 59	08 32	09 26	10 40
60	17 16	17 59	18 47	08 20	08 58	09 53	11 03
N 58	17 21	18 01	18 46	08 38	09 18	10 13	11 21
56	17 25	18 02	18 46	08 52	09 35	10 30	11 37
54	17 28	18 04	18 45	09 05	09 50	10 45	11 50
52	17 32	18 06	18 45	09 16	10 02	10 58	12 01
50	17 35	18 07	18 45	09 26	10 13	11 09	12 12
45	17 41	18 11	18 45	09 48	10 36	11 32	12 33
N 40	17 47	18 14	18 46	10 05	10 55	11 51	12 50
35	17 52	18 17	18 47	10 19	11 11	12 06	13 04
30	17 56	18 20	18 48	10 32	11 24	12 20	13 17
20	18 03	18 26	18 51	10 53	11 47	12 43	13 38
N 10	18 10	18 31	18 56	11 12	12 07	13 02	13 57
0	18 16	18 37	19 02	11 29	12 26	13 21	14 14
S 10	18 23	18 44	19 09	11 47	12 44	13 39	14 31
20	18 30	18 52	19 18	12 05	13 04	13 59	14 49
30	18 38	19 02	19 31	12 27	13 27	14 22	15 10
35	18 43	19 09	19 39	12 40	13 41	14 35	15 22
40	18 48	19 16	19 49	12 54	13 56	14 50	15 36
45	18 54	19 25	20 02	13 12	14 15	15 08	15 53
S 50	19 02	19 36	20 17	13 33	14 38	15 31	16 13
52	19 05	19 41	20 25	13 44	14 49	15 42	16 23
54	19 09	19 47	20 34	13 55	15 01	15 54	16 34
56	19 14	19 53	20 44	14 08	15 16	16 08	16 46
58	19 18	20 01	20 55	14 24	15 33	16 24	17 00
S 60	19 24	20 09	21 09	14 42	15 53	16 44	17 17

Day	SUN Eqn. of Time 00^h	SUN Eqn. of Time 12^h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
24	13 18	13 14	12 13	05 16	17 44	21	55
25	13 10	13 05	12 13	06 12	18 40	22	45
26	13 00	12 55	12 13	07 08	19 35	23	34

UT	ARIES	VENUS −4.1		MARS +1.1		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
27 00	156 29.1	218 20.8	S19 52.0	181 01.9	S11 21.1	149 20.6	N 1 52.4	320 23.0	S 3 58.5
01	171 31.6	233 20.2	51.6	196 02.5	20.4	164 22.6	52.6	335 25.6	58.5
02	186 34.1	248 19.5	51.2	211 03.1	19.6	179 24.5	52.9	350 28.2	58.4
03	201 36.5	263 18.9	50.8	226 03.7	18.9	194 26.5	53.1	5 30.8	58.4
04	216 39.0	278 18.3	50.4	241 04.3	18.2	209 28.4	53.3	20 33.4	58.3
05	231 41.5	293 17.6	50.0	256 04.9	17.5	224 30.4	53.5	35 36.0	58.3
06	246 43.9	308 17.0	S19 49.6	271 05.5	S11 16.8	239 32.3	N 1 53.8	50 38.5	S 3 58.2
07	261 46.4	323 16.3	49.2	286 06.1	16.0	254 34.2	54.0	65 41.1	58.1
08	276 48.8	338 15.7	48.8	301 06.7	15.3	269 36.2	54.2	80 43.7	58.1
S 09	291 51.3	353 15.1	48.4	316 07.3	14.6	284 38.1	54.4	95 46.3	58.0
U 10	306 53.8	8 14.4	48.0	331 07.8	13.9	299 40.1	54.7	110 48.9	58.0
N 11	321 56.2	23 13.8	47.6	346 08.4	13.2	314 42.0	54.9	125 51.4	57.9
D 12	336 58.7	38 13.1	S19 47.2	1 09.0	S11 12.4	329 44.0	N 1 55.1	140 54.0	S 3 57.8
A 13	352 01.2	53 12.5	46.8	16 09.6	11.7	344 45.9	55.4	155 56.6	57.8
Y 14	7 03.6	68 11.9	46.4	31 10.2	11.0	359 47.8	55.6	170 59.2	57.7
15	22 06.1	83 11.2	46.0	46 10.8	10.3	14 49.8	55.8	186 01.8	57.7
16	37 08.6	98 10.6	45.6	61 11.4	09.5	29 51.7	56.0	201 04.4	57.6
17	52 11.0	113 09.9	45.2	76 12.0	08.8	44 53.7	56.3	216 06.9	57.6
18	67 13.5	128 09.3	S19 44.8	91 12.6	S11 08.1	59 55.6	N 1 56.5	231 09.5	S 3 57.5
19	82 15.9	143 08.7	44.4	106 13.2	07.4	74 57.6	56.7	246 12.1	57.4
20	97 18.4	158 08.0	44.0	121 13.8	06.7	89 59.5	57.0	261 14.7	57.4
21	112 20.9	173 07.4	43.6	136 14.3	05.9	105 01.4	57.2	276 17.3	57.3
22	127 23.3	188 06.8	43.2	151 14.9	05.2	120 03.4	57.4	291 19.9	57.3
23	142 25.8	203 06.1	42.7	166 15.5	04.5	135 05.3	57.6	306 22.4	57.2
28 00	157 28.3	218 05.5	S19 42.3	181 16.1	S11 03.8	150 07.3	N 1 57.9	321 25.0	S 3 57.1
01	172 30.7	233 04.8	41.9	196 16.7	03.0	165 09.2	58.1	336 27.6	57.1
02	187 33.2	248 04.2	41.5	211 17.3	02.3	180 11.2	58.3	351 30.2	57.0
03	202 35.7	263 03.6	41.1	226 17.9	01.6	195 13.1	58.6	6 32.8	57.0
04	217 38.1	278 02.9	40.7	241 18.5	00.9	210 15.0	58.8	21 35.4	56.9
05	232 40.6	293 02.3	40.3	256 19.1	11 00.1	225 17.0	59.0	36 37.9	56.9
06	247 43.1	308 01.7	S19 39.8	271 19.7	S10 59.4	240 18.9	N 1 59.2	51 40.5	S 3 56.8
07	262 45.5	323 01.0	39.4	286 20.3	58.7	255 20.9	59.5	66 43.1	56.7
08	277 48.0	338 00.4	39.0	301 20.9	58.0	270 22.8	59.7	81 45.7	56.7
M 09	292 50.4	352 59.7	38.6	316 21.5	57.2	285 24.7	1 59.9	96 48.3	56.6
O 10	307 52.9	7 59.1	38.2	331 22.1	56.5	300 26.7	2 00.2	111 50.9	56.6
N 11	322 55.4	22 58.5	37.7	346 22.7	55.8	315 28.6	00.4	126 53.5	56.5
D 12	337 57.8	37 57.8	S19 37.3	1 23.2	S10 55.1	330 30.6	N 2 00.6	141 56.0	S 3 56.4
A 13	353 00.3	52 57.2	36.9	16 23.8	54.3	345 32.5	00.8	156 58.6	56.4
Y 14	8 02.8	67 56.6	36.5	31 24.4	53.6	0 34.5	01.1	172 01.2	56.3
15	23 05.2	82 55.9	36.0	46 25.0	52.9	15 36.4	01.3	187 03.8	56.3
16	38 07.7	97 55.3	35.6	61 25.6	52.2	30 38.3	01.5	202 06.4	56.2
17	53 10.2	112 54.7	35.2	76 26.2	51.4	45 40.3	01.8	217 09.0	56.1
18	68 12.6	127 54.0	S19 34.7	91 26.8	S10 50.7	60 42.2	N 2 02.0	232 11.6	S 3 56.1
19	83 15.1	142 53.4	34.3	106 27.4	50.0	75 44.2	02.2	247 14.1	56.0
20	98 17.6	157 52.8	33.9	121 28.0	49.3	90 46.1	02.4	262 16.7	56.0
21	113 20.0	172 52.1	33.4	136 28.6	48.5	105 48.0	02.7	277 19.3	55.9
22	128 22.5	187 51.5	33.0	151 29.2	47.8	120 50.0	02.9	292 21.9	55.8
23	143 24.9	202 50.9	32.6	166 29.8	47.1	135 51.9	03.1	307 24.5	55.8
1 00	158 27.4	217 50.2	S19 32.1	181 30.4	S10 46.4	150 53.9	N 2 03.4	322 27.1	S 3 55.7
01	173 29.9	232 49.6	31.7	196 31.0	45.6	165 55.8	03.6	337 29.7	55.7
02	188 32.3	247 48.9	31.3	211 31.6	44.9	180 57.7	03.8	352 32.3	55.6
03	203 34.8	262 48.3	30.8	226 32.2	44.2	195 59.7	04.0	7 34.8	55.5
04	218 37.3	277 47.7	30.4	241 32.8	43.4	211 01.6	04.3	22 37.4	55.5
05	233 39.7	292 47.0	29.9	256 33.4	42.7	226 03.6	04.5	37 40.0	55.4
06	248 42.2	307 46.4	S19 29.5	271 34.0	S10 42.0	241 05.5	N 2 04.7	52 42.6	S 3 55.4
07	263 44.7	322 45.8	29.1	286 34.6	41.3	256 07.4	05.0	67 45.2	55.3
T 08	278 47.1	337 45.1	28.6	301 35.2	40.5	271 09.4	05.2	82 47.8	55.2
U 09	293 49.6	352 44.5	28.2	316 35.8	39.8	286 11.3	05.4	97 50.4	55.2
E 10	308 52.1	7 43.9	27.7	331 36.4	39.1	301 13.3	05.6	112 53.0	55.1
S 11	323 54.5	22 43.3	27.3	346 37.0	38.3	316 15.2	05.9	127 55.5	55.1
D 12	338 57.0	37 42.6	S19 26.8	1 37.6	S10 37.6	331 17.1	N 2 06.1	142 58.1	S 3 55.0
A 13	353 59.4	52 42.0	26.4	16 38.2	36.9	346 19.1	06.3	158 00.7	54.9
Y 14	9 01.9	67 41.4	25.9	31 38.8	36.1	1 21.0	06.6	173 03.3	54.9
15	24 04.4	82 40.7	25.5	46 39.4	35.4	16 23.0	06.8	188 05.9	54.8
16	39 06.8	97 40.1	25.0	61 40.0	34.7	31 24.9	07.0	203 08.5	54.8
17	54 09.3	112 39.5	24.6	76 40.6	34.0	46 26.8	07.2	218 11.1	54.7
18	69 11.8	127 38.8	S19 24.1	91 41.2	S10 33.2	61 28.8	N 2 07.5	233 13.7	S 3 54.6
19	84 14.2	142 38.2	23.7	106 41.8	32.5	76 30.7	07.7	248 16.3	54.6
20	99 16.7	157 37.6	23.2	121 42.4	31.8	91 32.6	07.9	263 18.8	54.5
21	114 19.2	172 36.9	22.8	136 43.0	31.0	106 34.6	08.2	278 21.4	54.5
22	129 21.6	187 36.3	22.3	151 43.6	30.3	121 36.5	08.4	293 24.0	54.4
23	144 24.1	202 35.7	21.9	166 44.2	29.6	136 38.5	08.6	308 26.6	54.3
	h m								
Mer. Pass.	13 27.9	*v* −0.6	*d* 0.4	*v* 0.6	*d* 0.7	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.8
Achernar	335 28.3	S57 11.0
Acrux	173 10.6	S63 09.7
Adhara	255 13.6	S28 59.5
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.5	N55 53.6
Alkaid	152 59.8	N49 15.1
Al Na'ir	27 46.1	S46 54.4
Alnilam	275 47.9	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.3	N26 40.3
Alpheratz	357 45.5	N29 09.2
Altair	62 10.1	N 8 53.8
Ankaa	353 17.6	S42 14.8
Antares	112 28.3	S26 27.4
Arcturus	145 57.0	N19 07.2
Atria	107 31.7	S69 02.6
Avior	234 18.2	S59 33.0
Bellatrix	278 33.7	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.6	S52 42.4
Capella	280 36.8	N46 00.7
Deneb	49 33.0	N45 19.1
Denebola	182 35.0	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.9	N61 41.2
Elnath	278 14.6	N28 37.0
Eltanin	90 47.1	N51 29.0
Enif	33 49.0	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.3	S57 10.6
Gienah	175 53.7	S17 36.4
Hadar	148 49.9	S60 25.5
Hamal	328 02.8	N23 31.0
Kaus Aust.	83 46.1	S34 22.6
Kochab	137 19.3	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.3	S36 25.5
Miaplacidus	221 39.3	S69 46.0
Mirfak	308 42.9	N49 54.2
Nunki	76 00.5	S26 16.9
Peacock	53 22.2	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.0	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.5	S 8 11.5
Rigil Kent.	139 53.7	S60 52.7
Sabik	102 14.5	S15 44.3
Schedar	349 43.0	N56 36.1
Shaula	96 24.2	S37 06.6
Sirius	258 35.0	S16 44.1
Spica	158 32.7	S11 13.4
Suhail	222 53.3	S43 28.9
Vega	80 40.3	N38 47.4
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	60 37.2	9 28
Mars	23 47.9	11 54
Jupiter	352 39.0	13 58
Saturn	163 56.8	2 34

UT	SUN			MOON					
	GHA		Dec	GHA	v		Dec	d	HP
d h	° ′		° ′	° ′	′		° ′	′	′
27 00	176 47.5	S	8 33.3	243 54.1	9.0	S	23 14.6	3.5	56.3
01	191 47.6		32.4	258 22.1	9.0		23 11.1	3.5	56.2
02	206 47.7		31.4	272 50.1	9.1		23 07.6	3.7	56.2
03	221 47.8	. .	30.5	287 18.2	9.2		23 03.9	3.8	56.2
04	236 47.9		29.6	301 46.4	9.2		23 00.1	4.0	56.2
05	251 48.0		28.6	316 14.6	9.3		22 56.1	4.0	56.1
06	266 48.1	S	8 27.7	330 42.9	9.3	S	22 52.1	4.2	56.1
07	281 48.2		26.8	345 11.2	9.4		22 47.9	4.3	56.1
08	296 48.3		25.8	359 39.6	9.5		22 43.6	4.4	56.1
S 09	311 48.4	. .	24.9	14 08.1	9.5		22 39.2	4.5	56.0
U 10	326 48.5		23.9	28 36.6	9.6		22 34.7	4.6	56.0
N 11	341 48.7		23.0	43 05.2	9.7		22 30.1	4.8	56.0
D 12	356 48.8	S	8 22.1	57 33.9	9.8	S	22 25.3	4.8	55.9
A 13	11 48.9		21.1	72 02.7	9.8		22 20.5	5.0	55.9
Y 14	26 49.0		20.2	86 31.5	9.9		22 15.5	5.1	55.9
15	41 49.1	. .	19.2	101 00.4	9.9		22 10.4	5.2	55.9
16	56 49.2		18.3	115 29.3	10.0		22 05.2	5.2	55.8
17	71 49.3		17.4	129 58.3	10.1		22 00.0	5.5	55.8
18	86 49.4	S	8 16.4	144 27.4	10.1	S	21 54.5	5.5	55.8
19	101 49.5		15.5	158 56.5	10.3		21 49.0	5.6	55.8
20	116 49.6		14.5	173 25.8	10.3		21 43.4	5.7	55.8
21	131 49.8	. .	13.6	187 55.1	10.3		21 37.7	5.8	55.7
22	146 49.9		12.6	202 24.4	10.5		21 31.9	6.0	55.7
23	161 50.0		11.7	216 53.9	10.5		21 25.9	6.0	55.7
28 00	176 50.1	S	8 10.8	231 23.4	10.5	S	21 19.9	6.1	55.7
01	191 50.2		09.8	245 52.9	10.7		21 13.8	6.3	55.6
02	206 50.3		08.9	260 22.6	10.7		21 07.5	6.3	55.6
03	221 50.4	. .	07.9	274 52.3	10.8		21 01.2	6.5	55.6
04	236 50.5		07.0	289 22.1	10.8		20 54.7	6.5	55.6
05	251 50.7		06.0	303 51.9	10.9		20 48.2	6.6	55.5
06	266 50.8	S	8 05.1	318 21.8	11.0	S	20 41.6	6.8	55.5
07	281 50.9		04.2	332 51.8	11.1		20 34.8	6.8	55.5
08	296 51.0		03.2	347 21.9	11.1		20 28.0	6.9	55.5
M 09	311 51.1	. .	02.3	1 52.0	11.3		20 21.1	7.0	55.5
O 10	326 51.2		01.3	16 22.3	11.2		20 14.1	7.1	55.4
N 11	341 51.3		8 00.4	30 52.5	11.4		20 07.0	7.2	55.4
D 12	356 51.4	S	7 59.4	45 22.9	11.4	S	19 59.8	7.3	55.4
A 13	11 51.6		58.5	59 53.3	11.5		19 52.5	7.4	55.4
Y 14	26 51.7		57.5	74 23.8	11.6		19 45.1	7.5	55.3
15	41 51.8	. .	56.6	88 54.4	11.6		19 37.6	7.5	55.3
16	56 51.9		55.6	103 25.0	11.7		19 30.1	7.7	55.3
17	71 52.0		54.7	117 55.7	11.8		19 22.4	7.7	55.3
18	86 52.1	S	7 53.8	132 26.5	11.8	S	19 14.7	7.8	55.3
19	101 52.3		52.8	146 57.3	11.9		19 06.9	7.9	55.2
20	116 52.4		51.9	161 28.2	12.0		18 59.0	8.0	55.2
21	131 52.5	. .	50.9	175 59.2	12.1		18 51.0	8.1	55.2
22	146 52.6		50.0	190 30.3	12.1		18 42.9	8.1	55.2
23	161 52.7		49.0	205 01.4	12.2		18 34.8	8.3	55.2
1 00	176 52.8	S	7 48.1	219 32.6	12.3	S	18 26.5	8.3	55.1
01	191 53.0		47.1	234 03.9	12.3		18 18.2	8.4	55.1
02	206 53.1		46.2	248 35.2	12.4		18 09.8	8.4	55.1
03	221 53.2	. .	45.2	263 06.6	12.5		18 01.4	8.6	55.1
04	236 53.3		44.3	277 38.1	12.5		17 52.8	8.6	55.1
05	251 53.4		43.3	292 09.6	12.6		17 44.2	8.7	55.1
06	266 53.5	S	7 42.4	306 41.2	12.7	S	17 35.5	8.8	55.0
07	281 53.7		41.4	321 12.9	12.7		17 26.7	8.8	55.0
T 08	296 53.8		40.5	335 44.6	12.8		17 17.9	8.9	55.0
U 09	311 53.9	. .	39.5	350 16.4	12.9		17 09.0	9.0	55.0
E 10	326 54.0		38.6	4 48.3	12.9		17 00.0	9.1	55.0
S 11	341 54.1		37.6	19 20.2	13.0		16 50.9	9.1	54.9
D 12	356 54.3	S	7 36.7	33 52.2	13.1	S	16 41.8	9.2	54.9
A 13	11 54.4		35.7	48 24.3	13.2		16 32.6	9.2	54.9
Y 14	26 54.5		34.8	62 56.5	13.1		16 23.4	9.4	54.9
15	41 54.6	. .	33.8	77 28.6	13.3		16 14.0	9.4	54.9
16	56 54.7		32.9	92 00.9	13.3		16 04.6	9.4	54.9
17	71 54.9		31.9	106 33.2	13.4		15 55.2	9.6	54.8
18	86 55.0	S	7 31.0	121 05.6	13.5	S	15 45.6	9.5	54.8
19	101 55.1		30.0	135 38.1	13.5		15 36.1	9.7	54.8
20	116 55.2		29.1	150 10.6	13.6		15 26.4	9.7	54.8
21	131 55.3	. .	28.1	164 43.2	13.6		15 16.7	9.8	54.8
22	146 55.5		27.2	179 15.8	13.7		15 06.9	9.8	54.8
23	161 55.6		26.2	193 48.5	13.7	S	14 57.1	9.9	54.7
	SD 16.2		d 0.9	SD	15.2		15.1		15.0

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 27	Moonrise 28	Moonrise 1	Moonrise 2
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 17	06 34	07 44			08 33	07 33
N 70	05 21	06 31	07 34			07 35	07 07
68	05 24	06 29	07 25		07 25	07 01	06 48
66	05 27	06 26	07 18	06 46	06 41	06 36	06 32
64	05 29	06 24	07 12	05 59	06 11	06 17	06 19
62	05 31	06 22	07 07	05 28	05 49	06 01	06 08
60	05 33	06 21	07 03	05 05	05 31	05 47	05 59
N 58	05 34	06 19	06 59	04 46	05 16	05 36	05 51
56	05 35	06 18	06 55	04 31	05 03	05 26	05 43
54	05 35	06 16	06 52	04 17	04 51	05 17	05 37
52	05 36	06 15	06 49	04 06	04 41	05 09	05 31
50	05 36	06 14	06 46	03 55	04 32	05 02	05 25
45	05 37	06 11	06 40	03 33	04 13	04 46	05 14
N 40	05 37	06 08	06 36	03 16	03 58	04 34	05 04
35	05 37	06 06	06 31	03 01	03 45	04 23	04 56
30	05 36	06 03	06 28	02 48	03 33	04 13	04 49
20	05 33	05 59	06 21	02 26	03 14	03 57	04 36
N 10	05 29	05 54	06 15	02 07	02 56	03 42	04 25
0	05 24	05 48	06 09	01 49	02 40	03 29	04 15
S 10	05 17	05 42	06 03	01 31	02 24	03 15	04 04
20	05 09	05 35	05 57	01 12	02 07	03 01	03 53
30	04 57	05 26	05 50	00 49	01 47	02 44	03 40
35	04 49	05 20	05 46	00 36	01 35	02 34	03 33
40	04 40	05 13	05 41	00 21	01 22	02 23	03 24
45	04 28	05 05	05 35	00 04	01 06	02 10	03 14
S 50	04 14	04 55	05 28	24 46	00 46	01 54	03 02
52	04 06	04 50	05 25	24 37	00 37	01 46	02 56
54	03 58	04 44	05 22	24 27	00 27	01 38	02 50
56	03 49	04 38	05 18	24 15	00 15	01 29	02 43
58	03 38	04 31	05 13	24 01	00 01	01 18	02 35
S 60	03 25	04 24	05 09	23 45	25 05	01 05	02 26

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 27	Moonset 28	Moonset 1	Moonset 2
°	h m	h m	h m	h m	h m	h m	h m
N 72	16 43	17 53	19 11			11 04	13 38
N 70	16 53	17 56	19 07			12 00	14 02
68	17 02	17 58	19 03		10 31	12 34	14 20
66	17 08	18 01	19 00	09 23	11 14	12 57	14 34
64	17 14	18 03	18 58	10 10	11 43	13 16	14 46
62	17 19	18 04	18 56	10 40	12 05	13 31	14 56
60	17 24	18 06	18 54	11 03	12 22	13 44	15 05
N 58	17 28	18 07	18 53	11 21	12 37	13 55	15 12
56	17 31	18 09	18 52	11 37	12 49	14 04	15 19
54	17 34	18 10	18 51	11 50	13 00	14 13	15 25
52	17 37	18 11	18 50	12 01	13 10	14 20	15 30
50	17 40	18 12	18 50	12 12	13 18	14 27	15 35
45	17 45	18 15	18 49	12 33	13 37	14 41	15 45
N 40	17 50	18 17	18 49	12 50	13 51	14 53	15 53
35	17 54	18 20	18 49	13 04	14 04	15 03	16 00
30	17 58	18 22	18 50	13 17	14 15	15 11	16 07
20	18 05	18 27	18 52	13 38	14 33	15 26	16 18
N 10	18 10	18 32	18 56	13 57	14 49	15 39	16 27
0	18 16	18 37	19 01	14 14	15 04	15 51	16 36
S 10	18 22	18 43	19 07	14 31	15 19	16 03	16 45
20	18 28	18 50	19 16	14 49	15 35	16 16	16 54
30	18 35	18 59	19 28	15 10	15 53	16 31	17 04
35	18 39	19 05	19 35	15 22	16 03	16 39	17 10
40	18 44	19 11	19 44	15 36	16 15	16 48	17 17
45	18 49	19 19	19 56	15 53	16 29	16 59	17 25
S 50	18 56	19 29	20 10	16 13	16 46	17 13	17 35
52	18 59	19 34	20 17	16 23	16 54	17 19	17 39
54	19 02	19 39	20 25	16 34	17 03	17 26	17 44
56	19 06	19 45	20 34	16 46	17 13	17 33	17 49
58	19 10	19 52	20 45	17 00	17 25	17 42	17 55
S 60	19 15	20 00	20 57	17 17	17 38	17 52	18 02

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
27	12 50	12 45	12 13	08 01	20 27	24	25
28	12 40	12 34	12 13	08 52	21 17	25	17
1	12 29	12 23	12 12	09 40	22 03	26	10

UT	ARIES	VENUS −4.1		MARS +1.1		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
2 00	159 26.5	217 35.0	S19 21.4	181 44.8	S10 28.8	151 40.4	N 2 08.9	323 29.2	S 3 54.3
01	174 29.0	232 34.4	20.9	196 45.4	28.1	166 42.3	09.1	338 31.8	54.2
02	189 31.5	247 33.8	20.5	211 46.0	27.4	181 44.3	09.3	353 34.4	54.1
03	204 33.9	262 33.2	20.0	226 46.6	26.6	196 46.2	09.5	8 37.0	54.1
04	219 36.4	277 32.5	19.5	241 47.2	25.9	211 48.2	09.8	23 39.6	54.0
05	234 38.9	292 31.9	19.1	256 47.8	25.2	226 50.1	10.0	38 42.2	54.0
06	249 41.3	307 31.3	S19 18.6	271 48.4	S10 24.4	241 52.0	N 2 10.2	53 44.8	S 3 53.9
W 07	264 43.8	322 30.6	18.2	286 49.0	23.7	256 54.0	10.5	68 47.3	53.8
E 08	279 46.3	337 30.0	17.7	301 49.6	23.0	271 55.9	10.7	83 49.9	53.8
D 09	294 48.7	352 29.4	17.2	316 50.2	22.2	286 57.8	10.9	98 52.5	53.7
N 10	309 51.2	7 28.8	16.8	331 50.8	21.5	301 59.8	11.1	113 55.1	53.7
E 11	324 53.7	22 28.1	16.3	346 51.4	20.8	317 01.7	11.4	128 57.7	53.6
S 12	339 56.1	37 27.5	S19 15.8	1 52.0	S10 20.0	332 03.7	N 2 11.6	144 00.3	S 3 53.5
D 13	354 58.6	52 26.9	15.3	16 52.6	19.3	347 05.6	11.8	159 02.9	53.5
A 14	10 01.0	67 26.2	14.9	31 53.2	18.6	2 07.5	12.1	174 05.5	53.4
Y 15	25 03.5	82 25.6	14.4	46 53.8	17.8	17 09.5	12.3	189 08.1	53.3
16	40 06.0	97 25.0	13.9	61 54.4	17.1	32 11.4	12.5	204 10.7	53.3
17	55 08.4	112 24.4	13.4	76 55.0	16.4	47 13.3	12.8	219 13.3	53.2
18	70 10.9	127 23.7	S19 13.0	91 55.6	S10 15.6	62 15.3	N 2 13.0	234 15.9	S 3 53.2
19	85 13.4	142 23.1	12.5	106 56.2	14.9	77 17.2	13.2	249 18.4	53.1
20	100 15.8	157 22.5	12.0	121 56.8	14.2	92 19.2	13.4	264 21.0	53.0
21	115 18.3	172 21.9	11.5	136 57.4	13.4	107 21.1	13.7	279 23.6	53.0
22	130 20.8	187 21.2	11.1	151 58.0	12.7	122 23.0	13.9	294 26.2	52.9
23	145 23.2	202 20.6	10.6	166 58.6	12.0	137 25.0	14.1	309 28.8	52.9
3 00	160 25.7	217 20.0	S19 10.1	181 59.2	S10 11.2	152 26.9	N 2 14.4	324 31.4	S 3 52.8
01	175 28.1	232 19.3	09.6	196 59.8	10.5	167 28.8	14.6	339 34.0	52.7
02	190 30.6	247 18.7	09.1	212 00.4	09.8	182 30.8	14.8	354 36.6	52.7
03	205 33.1	262 18.1	08.6	227 01.0	09.0	197 32.7	15.1	9 39.2	52.6
04	220 35.5	277 17.5	08.2	242 01.6	08.3	212 34.6	15.3	24 41.8	52.5
05	235 38.0	292 16.8	07.7	257 02.2	07.5	227 36.6	15.5	39 44.4	52.5
06	250 40.5	307 16.2	S19 07.2	272 02.8	S10 06.8	242 38.5	N 2 15.7	54 47.0	S 3 52.4
T 07	265 42.9	322 15.6	06.7	287 03.4	06.1	257 40.5	16.0	69 49.6	52.4
H 08	280 45.4	337 15.0	06.2	302 04.0	05.3	272 42.4	16.2	84 52.2	52.3
U 09	295 47.9	352 14.4	05.7	317 04.6	04.6	287 44.3	16.4	99 54.8	52.2
R 10	310 50.3	7 13.7	05.2	332 05.2	03.9	302 46.3	16.7	114 57.3	52.2
S 11	325 52.8	22 13.1	04.7	347 05.9	03.1	317 48.2	16.9	129 59.9	52.1
D 12	340 55.3	37 12.5	S19 04.2	2 06.5	S10 02.4	332 50.1	N 2 17.1	145 02.5	S 3 52.0
A 13	355 57.7	52 11.9	03.8	17 07.1	01.6	347 52.1	17.4	160 05.1	52.0
Y 14	11 00.2	67 11.2	03.3	32 07.7	00.9	2 54.0	17.6	175 07.7	51.9
15	26 02.6	82 10.6	02.8	47 08.3	10 00.2	17 55.9	17.8	190 10.3	51.9
16	41 05.1	97 10.0	02.3	62 08.9	9 59.4	32 57.9	18.0	205 12.9	51.8
17	56 07.6	112 09.4	01.8	77 09.5	58.7	47 59.8	18.3	220 15.5	51.7
18	71 10.0	127 08.7	S19 01.3	92 10.1	S 9 58.0	63 01.7	N 2 18.5	235 18.1	S 3 51.7
19	86 12.5	142 08.1	00.8	107 10.7	57.2	78 03.7	18.7	250 20.7	51.6
20	101 15.0	157 07.5	19 00.3	122 11.3	56.5	93 05.6	19.0	265 23.3	51.5
21	116 17.4	172 06.9	18 59.8	137 11.9	55.7	108 07.5	19.2	280 25.9	51.5
22	131 19.9	187 06.3	59.3	152 12.5	55.0	123 09.5	19.4	295 28.5	51.4
23	146 22.4	202 05.6	58.8	167 13.1	54.3	138 11.4	19.7	310 31.1	51.4
4 00	161 24.8	217 05.0	S18 58.3	182 13.7	S 9 53.5	153 13.4	N 2 19.9	325 33.7	S 3 51.3
01	176 27.3	232 04.4	57.8	197 14.3	52.8	168 15.3	20.1	340 36.3	51.2
02	191 29.8	247 03.8	57.2	212 15.0	52.0	183 17.2	20.3	355 38.9	51.2
03	206 32.2	262 03.2	56.7	227 15.6	51.3	198 19.2	20.6	10 41.5	51.1
04	221 34.7	277 02.5	56.2	242 16.2	50.6	213 21.1	20.8	25 44.1	51.0
05	236 37.1	292 01.9	55.7	257 16.8	49.8	228 23.0	21.0	40 46.7	51.0
06	251 39.6	307 01.3	S18 55.2	272 17.4	S 9 49.1	243 25.0	N 2 21.3	55 49.3	S 3 50.9
07	266 42.1	322 00.7	54.7	287 18.0	48.3	258 26.9	21.5	70 51.9	50.8
08	281 44.5	337 00.1	54.2	302 18.6	47.6	273 28.8	21.7	85 54.4	50.8
F 09	296 47.0	351 59.4	53.7	317 19.2	46.9	288 30.8	22.0	100 57.0	50.7
R 10	311 49.5	6 58.8	53.2	332 19.8	46.1	303 32.7	22.2	115 59.6	50.7
I 11	326 51.9	21 58.2	52.6	347 20.4	45.4	318 34.6	22.4	131 02.2	50.6
D 12	341 54.4	36 57.6	S18 52.1	2 21.0	S 9 44.6	333 36.6	N 2 22.7	146 04.8	S 3 50.5
A 13	356 56.9	51 57.0	51.6	17 21.6	43.9	348 38.5	22.9	161 07.4	50.5
Y 14	11 59.3	66 56.3	51.1	32 22.3	43.2	3 40.4	23.1	176 10.0	50.4
15	27 01.8	81 55.7	50.6	47 22.9	42.4	18 42.4	23.3	191 12.6	50.3
16	42 04.2	96 55.1	50.1	62 23.5	41.7	33 44.3	23.6	206 15.2	50.3
17	57 06.7	111 54.5	49.5	77 24.1	40.9	48 46.2	23.8	221 17.8	50.2
18	72 09.2	126 53.9	S18 49.0	92 24.7	S 9 40.2	63 48.2	N 2 24.0	236 20.4	S 3 50.1
19	87 11.6	141 53.3	48.5	107 25.3	39.4	78 50.1	24.3	251 23.0	50.1
20	102 14.1	156 52.6	48.0	122 25.9	38.7	93 52.0	24.5	266 25.6	50.0
21	117 16.6	171 52.0	47.5	137 26.5	38.0	108 54.0	24.7	281 28.2	50.0
22	132 19.0	186 51.4	46.9	152 27.1	37.2	123 55.9	25.0	296 30.8	49.9
23	147 21.5	201 50.8	46.4	167 27.7	36.5	138 57.8	25.2	311 33.4	49.8
	h m								
Mer. Pass.	13 16.1	*v* −0.6	*d* 0.5	*v* 0.6	*d* 0.7	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.8
Achernar	335 28.3	S57 11.0
Acrux	173 10.6	S63 09.7
Adhara	255 13.6	S28 59.5
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.5	N55 53.6
Alkaid	152 59.7	N49 15.1
Al Na'ir	27 46.1	S46 54.3
Alnilam	275 47.9	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.2	N26 40.3
Alpheratz	357 45.6	N29 09.2
Altair	62 10.1	N 8 53.8
Ankaa	353 17.6	S42 14.8
Antares	112 28.2	S26 27.4
Arcturus	145 57.0	N19 07.2
Atria	107 31.6	S69 02.6
Avior	234 18.2	S59 33.0
Bellatrix	278 33.7	N 6 21.5
Betelgeuse	271 02.9	N 7 24.4
Canopus	263 56.7	S52 42.4
Capella	280 36.8	N46 00.7
Deneb	49 33.0	N45 19.1
Denebola	182 35.0	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.9	N61 41.2
Elnath	278 14.6	N28 37.0
Eltanin	90 47.1	N51 28.9
Enif	33 49.0	N 9 55.6
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.3	S57 10.6
Gienah	175 53.7	S17 36.4
Hadar	148 49.9	S60 25.5
Hamal	328 02.8	N23 31.0
Kaus Aust.	83 46.1	S34 22.6
Kochab	137 19.2	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.3	S36 25.5
Miaplacidus	221 39.3	S69 46.0
Mirfak	308 42.9	N49 54.2
Nunki	76 00.5	S26 16.9
Peacock	53 22.2	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.0	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.6	S 8 11.5
Rigil Kent.	139 53.7	S60 52.7
Sabik	102 14.4	S15 44.3
Schedar	349 43.0	N56 36.1
Shaula	96 24.2	S37 06.6
Sirius	258 35.0	S16 44.2
Spica	158 32.7	S11 13.4
Suhail	222 53.3	S43 28.9
Vega	80 40.3	N38 47.4
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	56 54.3	9 31
Mars	21 33.5	11 52
Jupiter	352 01.2	13 48
Saturn	164 05.7	2 21

UT	SUN			MOON					
	GHA		Dec	GHA		v	Dec		d	HP
d h	°	′	° ′	°	′	′	°	′	′	′
2 00	176	55.7	S 7 25.3	208	21.2	13.9	S14	47.2	10.0	54.7
01	191	55.8	24.3	222	54.1	13.8	14	37.2	10.0	54.7
02	206	56.0	23.4	237	26.9	14.0	14	27.2	10.0	54.7
03	221	56.1	. . 22.4	251	59.9	13.9	14	17.2	10.2	54.7
04	236	56.2	21.5	266	32.8	14.1	14	07.0	10.1	54.7
05	251	56.3	20.5	281	05.9	14.1	13	56.9	10.3	54.7
06	266	56.4	S 7 19.6	295	39.0	14.1	S13	46.6	10.2	54.6
W 07	281	56.6	18.6	310	12.1	14.3	13	36.4	10.4	54.6
E 08	296	56.7	17.6	324	45.4	14.2	13	26.0	10.4	54.6
D 09	311	56.8	. . 16.7	339	18.6	14.4	13	15.6	10.4	54.6
N 10	326	56.9	15.7	353	52.0	14.3	13	05.2	10.5	54.6
E 11	341	57.1	14.8	8	25.3	14.5	12	54.7	10.5	54.6
S 12	356	57.2	S 7 13.8	22	58.8	14.4	S12	44.2	10.6	54.6
D 13	11	57.3	12.9	37	32.2	14.6	12	33.6	10.6	54.5
A 14	26	57.4	11.9	52	05.8	14.6	12	23.0	10.7	54.5
Y 15	41	57.6	. . 11.0	66	39.4	14.6	12	12.3	10.7	54.5
16	56	57.7	10.0	81	13.0	14.7	12	01.6	10.8	54.5
17	71	57.8	09.1	95	46.7	14.7	11	50.8	10.8	54.5
18	86	57.9	S 7 08.1	110	20.4	14.8	S11	40.0	10.8	54.5
19	101	58.1	07.1	124	54.2	14.8	11	29.2	10.9	54.5
20	116	58.2	06.2	139	28.0	14.9	11	18.3	11.0	54.5
21	131	58.3	. . 05.2	154	01.9	14.9	11	07.3	10.9	54.4
22	146	58.5	04.3	168	35.8	15.0	10	56.4	11.0	54.4
23	161	58.6	03.3	183	09.8	15.0	10	45.4	11.1	54.4
3 00	176	58.7	S 7 02.4	197	43.8	15.1	S10	34.3	11.1	54.4
01	191	58.8	01.4	212	17.9	15.1	10	23.2	11.1	54.4
02	206	59.0	7 00.5	226	52.0	15.1	10	12.1	11.2	54.4
03	221	59.1	6 59.5	241	26.1	15.2	10	00.9	11.2	54.4
04	236	59.2	58.5	256	00.3	15.3	9	49.7	11.2	54.4
05	251	59.3	57.6	270	34.6	15.2	9	38.5	11.3	54.4
06	266	59.5	S 6 56.6	285	08.8	15.4	S 9	27.2	11.3	54.3
07	281	59.6	55.7	299	43.2	15.3	9	15.9	11.3	54.3
T 08	296	59.7	54.7	314	17.5	15.4	9	04.6	11.4	54.3
H 09	311	59.9	. . 53.7	328	51.9	15.4	8	53.2	11.4	54.3
U 10	327	00.0	52.8	343	26.3	15.5	8	41.8	11.4	54.3
R 11	342	00.1	51.8	358	00.8	15.5	8	30.4	11.4	54.3
S 12	357	00.2	S 6 50.9	12	35.3	15.5	S 8	19.0	11.5	54.3
D 13	12	00.4	49.9	27	09.8	15.6	8	07.5	11.5	54.3
A 14	27	00.5	49.0	41	44.4	15.6	7	56.0	11.6	54.3
Y 15	42	00.6	. . 48.0	56	19.0	15.7	7	44.4	11.5	54.2
16	57	00.8	47.0	70	53.7	15.7	7	32.9	11.6	54.2
17	72	00.9	46.1	85	28.4	15.7	7	21.3	11.6	54.2
18	87	01.0	S 6 45.1	100	03.1	15.7	S 7	09.7	11.7	54.2
19	102	01.2	44.2	114	37.8	15.8	6	58.0	11.6	54.2
20	117	01.3	43.2	129	12.6	15.8	6	46.4	11.7	54.2
21	132	01.4	. . 42.2	143	47.4	15.8	6	34.7	11.7	54.2
22	147	01.6	41.3	158	22.2	15.9	6	23.0	11.7	54.2
23	162	01.7	40.3	172	57.1	15.9	6	11.3	11.8	54.2
4 00	177	01.8	S 6 39.4	187	32.0	15.9	S 5	59.5	11.7	54.2
01	192	02.0	38.4	202	06.9	15.9	5	47.8	11.8	54.2
02	207	02.1	37.4	216	41.8	16.0	5	36.0	11.8	54.2
03	222	02.2	. . 36.5	231	16.8	16.0	5	24.2	11.8	54.1
04	237	02.4	35.5	245	51.8	16.0	5	12.4	11.9	54.1
05	252	02.5	34.6	260	26.8	16.1	5	00.5	11.8	54.1
06	267	02.6	S 6 33.6	275	01.9	16.0	S 4	48.7	11.9	54.1
07	282	02.8	32.6	289	36.9	16.1	4	36.8	11.9	54.1
08	297	02.9	31.7	304	12.0	16.1	4	24.9	11.8	54.1
F 09	312	03.0	. . 30.7	318	47.1	16.2	4	13.1	11.9	54.1
R 10	327	03.2	29.7	333	22.3	16.1	4	01.2	12.0	54.1
I 11	342	03.3	28.8	347	57.4	16.2	3	49.2	11.9	54.1
D 12	357	03.4	S 6 27.8	2	32.6	16.2	S 3	37.3	11.9	54.1
A 13	12	03.6	26.9	17	07.8	16.2	3	25.4	12.0	54.1
Y 14	27	03.7	25.9	31	43.0	16.2	3	13.4	11.9	54.1
15	42	03.8	. . 24.9	46	18.2	16.2	3	01.5	12.0	54.1
16	57	04.0	24.0	60	53.4	16.3	2	49.5	12.0	54.1
17	72	04.1	23.0	75	28.7	16.2	2	37.5	11.9	54.0
18	87	04.2	S 6 22.0	90	03.9	16.3	S 2	25.6	12.0	54.0
19	102	04.4	21.1	104	39.2	16.3	2	13.6	12.0	54.0
20	117	04.5	20.1	119	14.5	16.3	2	01.6	12.0	54.0
21	132	04.6	. . 19.2	133	49.8	16.3	1	49.6	12.0	54.0
22	147	04.8	18.2	148	25.1	16.3	1	37.6	12.0	54.0
23	162	04.9	17.2	163	00.4	16.4	S 1	25.6	12.0	54.0
	SD	16.2	d 1.0	SD		14.9		14.8		14.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 2	Moonrise 3	Moonrise 4	Moonrise 5
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 02	06 20	07 28	07 33	07 03	06 41	06 21
N 70	05 08	06 18	07 20	07 07	06 49	06 34	06 21
68	05 12	06 17	07 13	06 48	06 38	06 29	06 21
66	05 16	06 15	07 07	06 32	06 28	06 24	06 20
64	05 19	06 14	07 02	06 19	06 20	06 20	06 20
62	05 22	06 13	06 58	06 08	06 13	06 17	06 20
60	05 24	06 12	06 54	05 59	06 07	06 14	06 20
N 58	05 26	06 11	06 50	05 51	06 02	06 12	06 20
56	05 27	06 10	06 47	05 43	05 57	06 09	06 20
54	05 29	06 09	06 45	05 37	05 53	06 07	06 20
52	05 30	06 09	06 42	05 31	05 49	06 05	06 20
50	05 30	06 08	06 40	05 25	05 46	06 03	06 20
45	05 32	06 06	06 35	05 14	05 38	06 00	06 20
N 40	05 33	06 04	06 31	05 04	05 32	05 56	06 20
35	05 33	06 02	06 27	04 56	05 26	05 54	06 20
30	05 33	06 00	06 24	04 49	05 21	05 51	06 20
20	05 31	05 57	06 19	04 36	05 13	05 47	06 20
N 10	05 28	05 52	06 14	04 25	05 05	05 43	06 20
0	05 24	05 48	06 09	04 15	04 58	05 40	06 20
S 10	05 18	05 43	06 04	04 04	04 51	05 36	06 20
20	05 10	05 36	05 58	03 53	04 43	05 32	06 20
30	04 59	05 28	05 52	03 40	04 35	05 28	06 21
35	04 52	05 23	05 48	03 33	04 30	05 26	06 21
40	04 44	05 17	05 44	03 24	04 24	05 23	06 21
45	04 33	05 09	05 39	03 14	04 17	05 19	06 21
S 50	04 20	05 00	05 33	03 02	04 09	05 15	06 21
52	04 13	04 56	05 31	02 56	04 06	05 14	06 21
54	04 05	04 51	05 28	02 50	04 02	05 12	06 21
56	03 57	04 45	05 24	02 43	03 57	05 09	06 21
58	03 47	04 39	05 21	02 35	03 52	05 07	06 21
S 60	03 36	04 32	05 16	02 26	03 46	05 04	06 21

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 2	Moonset 3	Moonset 4	Moonset 5
°	h m	h m	h m	h m	h m	h m	h m
N 72	16 58	18 07	19 25	13 38	15 37	17 26	19 12
N 70	17 06	18 08	19 19	14 02	15 49	17 30	19 09
68	17 13	18 09	19 14	14 20	15 59	17 33	19 06
66	17 19	18 10	19 10	14 34	16 07	17 36	19 03
64	17 24	18 11	19 06	14 46	16 13	17 38	19 01
62	17 28	18 12	19 04	14 56	16 19	17 40	18 59
60	17 31	18 13	19 01	15 05	16 24	17 41	18 58
N 58	17 35	18 14	18 59	15 12	16 28	17 43	18 56
56	17 38	18 15	18 58	15 19	16 32	17 44	18 55
54	17 40	18 16	18 57	15 25	16 35	17 45	18 54
52	17 43	18 16	18 55	15 30	16 38	17 46	18 53
50	17 45	18 17	18 55	15 35	16 41	17 47	18 52
45	17 50	18 19	18 53	15 45	16 47	17 49	18 50
N 40	17 54	18 21	18 52	15 53	16 52	17 51	18 49
35	17 57	18 22	18 52	16 00	16 57	17 52	18 47
30	18 00	18 24	18 52	16 07	17 01	17 53	18 46
20	18 06	18 28	18 53	16 18	17 07	17 56	18 44
N 10	18 11	18 32	18 56	16 27	17 13	17 58	18 42
0	18 15	18 36	19 00	16 36	17 18	17 59	18 40
S 10	18 20	18 41	19 06	16 45	17 24	18 01	18 38
20	18 25	18 48	19 14	16 54	17 29	18 03	18 36
30	18 31	18 56	19 24	17 04	17 36	18 05	18 34
35	18 35	19 01	19 31	17 10	17 39	18 06	18 33
40	18 39	19 07	19 39	17 17	17 43	18 08	18 31
45	18 44	19 14	19 50	17 25	17 48	18 09	18 30
S 50	18 50	19 23	20 03	17 35	17 54	18 11	18 28
52	18 52	19 27	20 09	17 39	17 56	18 12	18 27
54	18 55	19 32	20 17	17 44	17 59	18 13	18 26
56	18 58	19 37	20 25	17 49	18 02	18 14	18 25
58	19 02	19 43	20 35	17 55	18 06	18 15	18 23
S 60	19 06	19 50	20 46	18 02	18 09	18 16	18 22

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
2	12 17	12 11	12 12	10 25	22 47	27	5
3	12 05	11 59	12 12	11 08	23 29	28	2
4	11 53	11 47	12 12	11 50	24 10	29	0

UT	ARIES	VENUS −4.1		MARS +1.1		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
5 00	162 24.0	216 50.2	S18 45.9	182 28.4	S 9 35.7	153 59.8	N 2 25.4	326 36.0	S 3 49.8
01	177 26.4	231 49.6	45.3	197 29.0	35.0	169 01.7	25.7	341 38.6	49.7
02	192 28.9	246 48.9	44.8	212 29.6	34.2	184 03.6	25.9	356 41.2	49.6
03	207 31.4	261 48.3	. . 44.3	227 30.2	. . 33.5	199 05.6	. . 26.1	11 43.8	. . 49.6
04	222 33.8	276 47.7	43.8	242 30.8	32.8	214 07.5	26.3	26 46.4	49.5
05	237 36.3	291 47.1	43.2	257 31.4	32.0	229 09.4	26.6	41 49.0	49.4
06	252 38.7	306 46.5	S18 42.7	272 32.0	S 9 31.3	244 11.4	N 2 26.8	56 51.6	S 3 49.4
07	267 41.2	321 45.9	42.2	287 32.6	30.5	259 13.3	27.0	71 54.2	49.3
S 08	282 43.7	336 45.3	41.6	302 33.3	29.8	274 15.2	27.3	86 56.8	49.2
A 09	297 46.1	351 44.6	. . 41.1	317 33.9	. . 29.0	289 17.2	. . 27.5	101 59.4	. . 49.2
T 10	312 48.6	6 44.0	40.6	332 34.5	28.3	304 19.1	27.7	117 02.0	49.1
U 11	327 51.1	21 43.4	40.0	347 35.1	27.5	319 21.0	28.0	132 04.6	49.1
R 12	342 53.5	36 42.8	S18 39.5	2 35.7	S 9 26.8	334 23.0	N 2 28.2	147 07.2	S 3 49.0
D 13	357 56.0	51 42.2	38.9	17 36.3	26.1	349 24.9	28.4	162 09.8	48.9
A 14	12 58.5	66 41.6	38.4	32 36.9	25.3	4 26.8	28.7	177 12.4	48.9
Y 15	28 00.9	81 41.0	. . 37.9	47 37.5	. . 24.6	19 28.8	. . 28.9	192 15.0	. . 48.8
16	43 03.4	96 40.4	37.3	62 38.2	23.8	34 30.7	29.1	207 17.6	48.7
17	58 05.8	111 39.7	36.8	77 38.8	23.1	49 32.6	29.4	222 20.2	48.7
18	73 08.3	126 39.1	S18 36.2	92 39.4	S 9 22.3	64 34.5	N 2 29.6	237 22.8	S 3 48.6
19	88 10.8	141 38.5	35.7	107 40.0	21.6	79 36.5	29.8	252 25.4	48.5
20	103 13.2	156 37.9	35.1	122 40.6	20.8	94 38.4	30.0	267 28.0	48.5
21	118 15.7	171 37.3	. . 34.6	137 41.2	. . 20.1	109 40.3	. . 30.3	282 30.6	. . 48.4
22	133 18.2	186 36.7	34.1	152 41.8	19.3	124 42.3	30.5	297 33.2	48.3
23	148 20.6	201 36.1	33.5	167 42.5	18.6	139 44.2	30.7	312 35.8	48.3
6 00	163 23.1	216 35.5	S18 33.0	182 43.1	S 9 17.9	154 46.1	N 2 31.0	327 38.4	S 3 48.2
01	178 25.6	231 34.9	32.4	197 43.7	17.1	169 48.1	31.2	342 41.0	48.1
02	193 28.0	246 34.2	31.9	212 44.3	16.4	184 50.0	31.4	357 43.6	48.1
03	208 30.5	261 33.6	. . 31.3	227 44.9	. . 15.6	199 51.9	. . 31.7	12 46.2	. . 48.0
04	223 33.0	276 33.0	30.8	242 45.5	14.9	214 53.9	31.9	27 48.8	48.0
05	238 35.4	291 32.4	30.2	257 46.1	14.1	229 55.8	32.1	42 51.4	47.9
06	253 37.9	306 31.8	S18 29.6	272 46.8	S 9 13.4	244 57.7	N 2 32.4	57 54.0	S 3 47.8
07	268 40.3	321 31.2	29.1	287 47.4	12.6	259 59.7	32.6	72 56.6	47.8
08	283 42.8	336 30.6	28.5	302 48.0	11.9	275 01.6	32.8	87 59.2	47.7
S 09	298 45.3	351 30.0	. . 28.0	317 48.6	. . 11.1	290 03.5	. . 33.1	103 01.8	. . 47.6
U 10	313 47.7	6 29.4	27.4	332 49.2	10.4	305 05.4	33.3	118 04.4	47.6
N 11	328 50.2	21 28.8	26.9	347 49.8	09.6	320 07.4	33.5	133 07.0	47.5
D 12	343 52.7	36 28.2	S18 26.3	2 50.5	S 9 08.9	335 09.3	N 2 33.7	148 09.6	S 3 47.4
A 13	358 55.1	51 27.6	25.7	17 51.1	08.1	350 11.2	34.0	163 12.2	47.4
Y 14	13 57.6	66 26.9	25.2	32 51.7	07.4	5 13.2	34.2	178 14.9	47.3
15	29 00.1	81 26.3	. . 24.6	47 52.3	. . 06.6	20 15.1	. . 34.4	193 17.5	. . 47.2
16	44 02.5	96 25.7	24.1	62 52.9	05.9	35 17.0	34.7	208 20.1	47.2
17	59 05.0	111 25.1	23.5	77 53.5	05.1	50 19.0	34.9	223 22.7	47.1
18	74 07.4	126 24.5	S18 22.9	92 54.2	S 9 04.4	65 20.9	N 2 35.1	238 25.3	S 3 47.0
19	89 09.9	141 23.9	22.4	107 54.8	03.6	80 22.8	35.4	253 27.9	47.0
20	104 12.4	156 23.3	21.8	122 55.4	02.9	95 24.7	35.6	268 30.5	46.9
21	119 14.8	171 22.7	. . 21.2	137 56.0	. . 02.1	110 26.7	. . 35.8	283 33.1	. . 46.8
22	134 17.3	186 22.1	20.7	152 56.6	01.4	125 28.6	36.1	298 35.7	46.8
23	149 19.8	201 21.5	20.1	167 57.2	9 00.6	140 30.5	36.3	313 38.3	46.7
7 00	164 22.2	216 20.9	S18 19.5	182 57.9	S 8 59.9	155 32.5	N 2 36.5	328 40.9	S 3 46.6
01	179 24.7	231 20.3	18.9	197 58.5	59.1	170 34.4	36.8	343 43.5	46.6
02	194 27.2	246 19.7	18.4	212 59.1	58.4	185 36.3	37.0	358 46.1	46.5
03	209 29.6	261 19.1	. . 17.8	227 59.7	. . 57.6	200 38.3	. . 37.2	13 48.7	. . 46.4
04	224 32.1	276 18.5	17.2	243 00.3	56.9	215 40.2	37.5	28 51.3	46.4
05	239 34.6	291 17.9	16.6	258 01.0	56.1	230 42.1	37.7	43 53.9	46.3
06	254 37.0	306 17.3	S18 16.1	273 01.6	S 8 55.4	245 44.0	N 2 37.9	58 56.5	S 3 46.2
07	269 39.5	321 16.7	15.5	288 02.2	54.6	260 46.0	38.2	73 59.1	46.2
08	284 41.9	336 16.1	14.9	303 02.8	53.9	275 47.9	38.4	89 01.7	46.1
M 09	299 44.4	351 15.5	. . 14.3	318 03.4	. . 53.1	290 49.8	. . 38.6	104 04.3	. . 46.0
O 10	314 46.9	6 14.9	13.8	333 04.0	52.4	305 51.8	38.8	119 06.9	46.0
N 11	329 49.3	21 14.3	13.2	348 04.7	51.6	320 53.7	39.1	134 09.5	45.9
D 12	344 51.8	36 13.7	S18 12.6	3 05.3	S 8 50.9	335 55.6	N 2 39.3	149 12.1	S 3 45.8
A 13	359 54.3	51 13.1	12.0	18 05.9	50.1	350 57.5	39.5	164 14.8	45.8
Y 14	14 56.7	66 12.5	11.4	33 06.5	49.4	5 59.5	39.8	179 17.4	45.7
15	29 59.2	81 11.9	. . 10.8	48 07.1	. . 48.6	21 01.4	. . 40.0	194 20.0	. . 45.6
16	45 01.7	96 11.3	10.3	63 07.8	47.9	36 03.3	40.2	209 22.6	45.6
17	60 04.1	111 10.7	09.7	78 08.4	47.1	51 05.3	40.5	224 25.2	45.5
18	75 06.6	126 10.1	S18 09.1	93 09.0	S 8 46.4	66 07.2	N 2 40.7	239 27.8	S 3 45.4
19	90 09.0	141 09.5	08.5	108 09.6	45.6	81 09.1	40.9	254 30.4	45.4
20	105 11.5	156 08.9	07.9	123 10.3	44.9	96 11.0	41.2	269 33.0	45.3
21	120 14.0	171 08.3	. . 07.3	138 10.9	. . 44.1	111 13.0	. . 41.4	284 35.6	. . 45.2
22	135 16.4	186 07.7	06.7	153 11.5	43.4	126 14.9	41.6	299 38.2	45.2
23	150 18.9	201 07.1	06.1	168 12.1	42.6	141 16.8	41.9	314 40.8	45.1
	h m								
Mer. Pass.	13 04.3	*v* −0.6	*d* 0.6	*v* 0.6	*d* 0.7	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.8
Achernar	335 28.3	S57 11.0
Acrux	173 10.6	S63 09.7
Adhara	255 13.6	S28 59.5
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.5	N55 53.6
Alkaid	152 59.7	N49 15.1
Al Na'ir	27 46.1	S46 54.3
Alnilam	275 48.0	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.2	N26 40.3
Alpheratz	357 45.6	N29 09.2
Altair	62 10.0	N 8 53.8
Ankaa	353 17.6	S42 14.8
Antares	112 28.2	S26 27.4
Arcturus	145 57.0	N19 07.2
Atria	107 31.6	S69 02.6
Avior	234 18.3	S59 33.0
Bellatrix	278 33.7	N 6 21.5
Betelgeuse	271 03.0	N 7 24.4
Canopus	263 56.7	S52 42.4
Capella	280 36.8	N46 00.7
Deneb	49 33.0	N45 19.1
Denebola	182 35.0	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.9	N61 41.2
Elnath	278 14.6	N28 37.0
Eltanin	90 47.0	N51 28.9
Enif	33 49.0	N 9 55.5
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.3	S57 10.6
Gienah	175 53.7	S17 36.4
Hadar	148 49.9	S60 25.6
Hamal	328 02.8	N23 31.0
Kaus Aust.	83 46.1	S34 22.6
Kochab	137 19.1	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.3	S36 25.5
Miaplacidus	221 39.3	S69 46.1
Mirfak	308 42.9	N49 54.2
Nunki	76 00.5	S26 16.9
Peacock	53 22.2	S56 41.7
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.0	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.6	S 8 11.5
Rigil Kent.	139 53.7	S60 52.7
Sabik	102 14.4	S15 44.3
Schedar	349 43.0	N56 36.1
Shaula	96 24.2	S37 06.6
Sirius	258 35.0	S16 44.2
Spica	158 32.7	S11 13.4
Suhail	222 53.3	S43 29.0
Vega	80 40.2	N38 47.4
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	53 12.4	9 34
Mars	19 20.0	11 49
Jupiter	351 23.0	13 39
Saturn	164 15.3	2 09

UT	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise			
	GHA	Dec	GHA	v	Dec	d	HP		Naut.	Civil		5	6	7	8
d h	° ′	° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
5 00	177 05.0	S 6 16.3	177 35.8	16.3	S 1 13.6	12.0	54.0	N 72	04 46	06 05	07 13	06 21	06 01	05 39	05 11
01	192 05.2	15.3	192 11.1	16.4	1 01.6	12.0	54.0	N 70	04 54	06 05	07 06	06 21	06 07	05 53	05 36
02	207 05.3	14.3	206 46.5	16.3	0 49.6	12.0	54.0	68	05 00	06 05	07 00	06 21	06 12	06 04	05 55
03	222 05.5	. . 13.4	221 21.8	16.4	0 37.6	12.0	54.0	66	05 05	06 04	06 55	06 20	06 17	06 13	06 10
04	237 05.6	12.4	235 57.2	16.4	0 25.6	12.0	54.0	64	05 09	06 04	06 51	06 20	06 21	06 21	06 22
05	252 05.7	11.4	250 32.6	16.3	0 13.6	12.1	54.0	62	05 13	06 04	06 48	06 20	06 24	06 28	06 33
06	267 05.9	S 6 10.5	265 07.9	16.4	S 0 01.5	12.0	54.0	60	05 15	06 03	06 45	06 20	06 27	06 34	06 42
07	282 06.0	09.5	279 43.3	16.4	N 0 10.5	12.0	54.0	N 58	05 18	06 03	06 42	06 20	06 29	06 39	06 50
S 08	297 06.2	08.5	294 18.7	16.4	0 22.5	12.0	54.0	56	05 20	06 03	06 40	06 20	06 32	06 44	06 57
A 09	312 06.3	. . 07.6	308 54.1	16.4	0 34.5	11.9	54.0	54	05 22	06 02	06 38	06 20	06 34	06 48	07 04
T 10	327 06.4	06.6	323 29.5	16.4	0 46.4	12.0	54.0	52	05 23	06 02	06 36	06 20	06 35	06 52	07 10
U 11	342 06.6	05.6	338 04.9	16.4	0 58.4	12.0	54.0	50	05 24	06 02	06 34	06 20	06 37	06 55	07 15
R 12	357 06.7	S 6 04.7	352 40.3	16.4	N 1 10.4	12.0	54.0	45	05 27	06 01	06 30	06 20	06 41	07 03	07 26
D 13	12 06.8	03.7	7 15.7	16.3	1 22.4	12.0	54.0	N 40	05 28	05 59	06 26	06 20	06 44	07 09	07 36
A 14	27 07.0	02.7	21 51.0	16.4	1 34.4	11.9	54.0	35	05 29	05 58	06 24	06 20	06 47	07 14	07 44
Y 15	42 07.1	. . 01.8	36 26.4	16.4	1 46.3	12.0	54.0	30	05 29	05 57	06 21	06 20	06 49	07 19	07 51
16	57 07.3	6 00.8	51 01.8	16.4	1 58.3	11.9	54.0	20	05 29	05 54	06 16	06 20	06 54	07 28	08 03
17	72 07.4	5 59.8	65 37.2	16.4	2 10.2	11.9	53.9	N 10	05 27	05 51	06 12	06 20	06 57	07 35	08 14
18	87 07.5	S 5 58.9	80 12.6	16.3	N 2 22.1	12.0	53.9	0	05 23	05 47	06 08	06 20	07 01	07 42	08 25
19	102 07.7	57.9	94 47.9	16.4	2 34.1	11.9	53.9	S 10	05 18	05 43	06 04	06 20	07 05	07 49	08 35
20	117 07.8	56.9	109 23.3	16.4	2 46.0	11.9	53.9	20	05 11	05 37	05 59	06 20	07 08	07 57	08 46
21	132 08.0	. . 56.0	123 58.7	16.3	2 57.9	11.9	53.9	30	05 02	05 30	05 54	06 21	07 13	08 05	08 59
22	147 08.1	55.0	138 34.0	16.4	3 09.8	11.8	53.9	35	04 55	05 25	05 51	06 21	07 15	08 11	09 06
23	162 08.2	54.0	153 09.4	16.3	3 21.6	11.9	53.9	40	04 47	05 20	05 47	06 21	07 18	08 16	09 15
6 00	177 08.4	S 5 53.1	167 44.7	16.3	N 3 33.5	11.8	53.9	45	04 38	05 13	05 43	06 21	07 22	08 23	09 25
01	192 08.5	52.1	182 20.0	16.3	3 45.3	11.9	53.9	S 50	04 25	05 05	05 38	06 21	07 26	08 31	09 37
02	207 08.7	51.1	196 55.3	16.4	3 57.2	11.8	53.9	52	04 19	05 01	05 36	06 21	07 28	08 35	09 43
03	222 08.8	. . 50.2	211 30.7	16.2	4 09.0	11.8	53.9	54	04 13	04 57	05 34	06 21	07 30	08 39	09 49
04	237 09.0	49.2	226 05.9	16.3	4 20.8	11.8	53.9	56	04 05	04 52	05 31	06 21	07 32	08 44	09 56
05	252 09.1	48.2	240 41.2	16.3	4 32.6	11.7	53.9	58	03 56	04 47	05 28	06 21	07 35	08 49	10 04
06	267 09.2	S 5 47.3	255 16.5	16.2	N 4 44.3	11.8	53.9	S 60	03 45	04 40	05 24	06 21	07 38	08 55	10 13
07	282 09.4	46.3	269 51.7	16.3	4 56.1	11.7	53.9								
08	297 09.5	45.3	284 27.0	16.2	5 07.8	11.7	53.9	Lat.	Sunset	Twilight		Moonset			
S 09	312 09.7	. . 44.4	299 02.2	16.2	5 19.5	11.7	53.9			Civil	Naut.	5	6	7	8
U 10	327 09.8	43.4	313 37.4	16.2	5 31.2	11.6	53.9								
N 11	342 10.0	42.4	328 12.6	16.2	5 42.8	11.7	53.9	°	h m	h m	h m	h m	h m	h m	h m
D 12	357 10.1	S 5 41.4	342 47.8	16.1	N 5 54.5	11.6	53.9	N 72	17 12	18 20	19 40	19 12	21 00	22 56	25 18
A 13	12 10.2	40.5	357 22.9	16.2	6 06.1	11.6	53.9	N 70	17 19	18 20	19 31	19 09	20 48	22 33	24 29
Y 14	27 10.4	39.5	11 58.1	16.1	6 17.7	11.5	53.9	68	17 24	18 20	19 25	19 06	20 39	22 15	23 58
15	42 10.5	. . 38.5	26 33.2	16.1	6 29.2	11.6	53.9	66	17 29	18 20	19 20	19 03	20 31	22 01	23 35
16	57 10.7	37.6	41 08.3	16.0	6 40.8	11.5	53.9	64	17 33	18 20	19 15	19 01	20 25	21 50	23 17
17	72 10.8	36.6	55 43.3	16.1	6 52.3	11.5	53.9	62	17 36	18 20	19 12	18 59	20 19	21 40	23 03
18	87 11.0	S 5 35.6	70 18.4	16.0	N 7 03.8	11.4	53.9	60	17 39	18 21	19 09	18 58	20 14	21 32	22 50
19	102 11.1	34.7	84 53.4	16.0	7 15.2	11.5	53.9	N 58	17 42	18 21	19 06	18 56	20 10	21 25	22 40
20	117 11.3	33.7	99 28.4	16.0	7 26.7	11.4	53.9	56	17 44	18 21	19 04	18 55	20 06	21 18	22 31
21	132 11.4	. . 32.7	114 03.4	15.9	7 38.1	11.4	53.9	54	17 46	18 21	19 02	18 54	20 03	21 13	22 23
22	147 11.5	31.7	128 38.3	16.0	7 49.5	11.3	53.9	52	17 48	18 22	19 01	18 53	20 00	21 07	22 15
23	162 11.7	30.8	143 13.3	15.9	8 00.8	11.3	53.9	50	17 50	18 22	18 59	18 52	19 57	21 03	22 09
7 00	177 11.8	S 5 29.8	157 48.2	15.8	N 8 12.1	11.3	54.0	45	17 54	18 23	18 57	18 50	19 51	20 53	21 55
01	192 12.0	28.8	172 23.0	15.9	8 23.4	11.3	54.0	N 40	17 57	18 24	18 55	18 49	19 46	20 45	21 43
02	207 12.1	27.9	186 57.9	15.8	8 34.7	11.2	54.0	35	18 00	18 25	18 54	18 47	19 42	20 37	21 34
03	222 12.3	. . 26.9	201 32.7	15.8	8 45.9	11.2	54.0	30	18 02	18 26	18 54	18 46	19 38	20 31	21 25
04	237 12.4	25.9	216 07.5	15.8	8 57.1	11.1	54.0	20	18 07	18 29	18 54	18 44	19 32	20 21	21 11
05	252 12.6	24.9	230 42.3	15.7	9 08.2	11.2	54.0	N 10	18 11	18 32	18 56	18 42	19 26	20 11	20 58
06	267 12.7	S 5 24.0	245 17.0	15.7	N 9 19.4	11.0	54.0	0	18 15	18 35	18 59	18 40	19 21	20 02	20 46
07	282 12.9	23.0	259 51.7	15.6	9 30.4	11.1	54.0	S 10	18 19	18 40	19 04	18 38	19 15	19 54	20 34
08	297 13.0	22.0	274 26.3	15.7	9 41.5	11.0	54.0	20	18 23	18 45	19 11	18 36	19 10	19 44	20 21
M 09	312 13.2	. . 21.1	289 01.0	15.6	9 52.5	11.0	54.0	30	18 28	18 52	19 21	18 34	19 03	19 34	20 07
O 10	327 13.3	20.1	303 35.6	15.5	10 03.5	10.9	54.0	35	18 31	18 57	19 27	18 33	19 00	19 28	19 59
N 11	342 13.5	19.1	318 10.1	15.6	10 14.4	10.9	54.0	40	18 34	19 02	19 34	18 31	18 55	19 21	19 49
D 12	357 13.6	S 5 18.1	332 44.7	15.5	N10 25.3	10.9	54.0	45	18 38	19 08	19 44	18 30	18 51	19 13	19 38
A 13	12 13.7	17.2	347 19.2	15.4	10 36.2	10.8	54.0	S 50	18 43	19 16	19 56	18 28	18 45	19 03	19 25
Y 14	27 13.9	16.2	1 53.6	15.4	10 47.0	10.7	54.0	52	18 46	19 20	20 02	18 27	18 42	18 59	19 19
15	42 14.0	. . 15.2	16 28.0	15.4	10 57.7	10.8	54.0	54	18 48	19 24	20 08	18 26	18 39	18 54	19 12
16	57 14.2	14.3	31 02.4	15.3	11 08.5	10.7	54.0	56	18 51	19 29	20 16	18 25	18 36	18 49	19 04
17	72 14.3	13.3	45 36.7	15.4	11 19.2	10.6	54.0	58	18 54	19 34	20 25	18 23	18 33	18 43	18 56
18	87 14.5	S 5 12.3	60 11.1	15.2	N11 29.8	10.6	54.0	S 60	18 57	19 40	20 35	18 22	18 29	18 36	18 46
19	102 14.6	11.3	74 45.3	15.2	11 40.4	10.6	54.0								
20	117 14.8	10.4	89 19.5	15.2	11 51.0	10.5	54.0		SUN			MOON			
21	132 14.9	. . 09.4	103 53.7	15.2	12 01.5	10.5	54.1	Day	Eqn. of Time		Mer.	Mer. Pass.		Age	Phase
22	147 15.1	08.4	118 27.9	15.1	12 12.0	10.4	54.1		00h	12h	Pass.	Upper	Lower		
23	162 15.2	07.4	133 02.0	15.0	N12 22.4	10.3	54.1	d	m s	m s	h m	h m	h m	d	%
	SD 16.1	d 1.0	SD	14.7		14.7		5	11 40	11 33	12 12	12 30	00 10	01	1
								6	11 27	11 20	12 11	13 11	00 50	02	3
								7	11 13	11 06	12 11	13 52	01 31	03	6

UT	ARIES	VENUS −4.1		MARS +1.1		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
8 00	165 21.4	216 06.5	S18 05.5	183 12.7	S 8 41.8	156 18.8	N 2 42.1	329 43.4	S 3 45.0
01	180 23.8	231 05.9	05.0	198 13.4	41.1	171 20.7	42.3	344 46.0	45.0
02	195 26.3	246 05.3	04.4	213 14.0	40.3	186 22.6	42.6	359 48.6	44.9
03	210 28.8	261 04.7	03.8	228 14.6	39.6	201 24.5	42.8	14 51.2	44.8
04	225 31.2	276 04.1	03.2	243 15.2	38.8	216 26.5	43.0	29 53.8	44.8
05	240 33.7	291 03.5	02.6	258 15.8	38.1	231 28.4	43.3	44 56.5	44.7
06	255 36.2	306 02.9	S18 02.0	273 16.5	S 8 37.3	246 30.3	N 2 43.5	59 59.1	S 3 44.6
07	270 38.6	321 02.3	01.4	288 17.1	36.6	261 32.3	43.7	75 01.7	44.6
08	285 41.1	336 01.7	00.8	303 17.7	35.8	276 34.2	44.0	90 04.3	44.5
T 09	300 43.5	351 01.1	18 00.2	318 18.3	35.1	291 36.1	44.2	105 06.9	44.4
U 10	315 46.0	6 00.5	17 59.6	333 19.0	34.3	306 38.0	44.4	120 09.5	44.4
E 11	330 48.5	20 59.9	59.0	348 19.6	33.6	321 40.0	44.6	135 12.1	44.3
S 12	345 50.9	35 59.3	S17 58.4	3 20.2	S 8 32.8	336 41.9	N 2 44.9	150 14.7	S 3 44.2
D 13	0 53.4	50 58.7	57.8	18 20.8	32.0	351 43.8	45.1	165 17.3	44.2
A 14	15 55.9	65 58.1	57.2	33 21.5	31.3	6 45.7	45.3	180 19.9	44.1
Y 15	30 58.3	80 57.5	56.6	48 22.1	30.5	21 47.7	45.6	195 22.5	44.0
16	46 00.8	95 56.9	56.0	63 22.7	29.8	36 49.6	45.8	210 25.1	44.0
17	61 03.3	110 56.3	55.3	78 23.3	29.0	51 51.5	46.0	225 27.7	43.9
18	76 05.7	125 55.7	S17 54.7	93 23.9	S 8 28.3	66 53.5	N 2 46.3	240 30.4	S 3 43.8
19	91 08.2	140 55.1	54.1	108 24.6	27.5	81 55.4	46.5	255 33.0	43.8
20	106 10.7	155 54.6	53.5	123 25.2	26.8	96 57.3	46.7	270 35.6	43.7
21	121 13.1	170 54.0	52.9	138 25.8	26.0	111 59.2	47.0	285 38.2	43.6
22	136 15.6	185 53.4	52.3	153 26.4	25.2	127 01.2	47.2	300 40.8	43.6
23	151 18.0	200 52.8	51.7	168 27.1	24.5	142 03.1	47.4	315 43.4	43.5
9 00	166 20.5	215 52.2	S17 51.1	183 27.7	S 8 23.7	157 05.0	N 2 47.7	330 46.0	S 3 43.4
01	181 23.0	230 51.6	50.5	198 28.3	23.0	172 06.9	47.9	345 48.6	43.4
02	196 25.4	245 51.0	49.8	213 28.9	22.2	187 08.9	48.1	0 51.2	43.3
03	211 27.9	260 50.4	49.2	228 29.6	21.5	202 10.8	48.4	15 53.8	43.2
04	226 30.4	275 49.8	48.6	243 30.2	20.7	217 12.7	48.6	30 56.4	43.2
05	241 32.8	290 49.2	48.0	258 30.8	19.9	232 14.6	48.8	45 59.1	43.1
06	256 35.3	305 48.6	S17 47.4	273 31.4	S 8 19.2	247 16.6	N 2 49.1	61 01.7	S 3 43.0
W 07	271 37.8	320 48.1	46.7	288 32.1	18.4	262 18.5	49.3	76 04.3	43.0
E 08	286 40.2	335 47.5	46.1	303 32.7	17.7	277 20.4	49.5	91 06.9	42.9
D 09	301 42.7	350 46.9	45.5	318 33.3	16.9	292 22.3	49.8	106 09.5	42.8
N 10	316 45.1	5 46.3	44.9	333 33.9	16.2	307 24.3	50.0	121 12.1	42.8
E 11	331 47.6	20 45.7	44.3	348 34.6	15.4	322 26.2	50.2	136 14.7	42.7
S 12	346 50.1	35 45.1	S17 43.6	3 35.2	S 8 14.6	337 28.1	N 2 50.5	151 17.3	S 3 42.6
D 13	1 52.5	50 44.5	43.0	18 35.8	13.9	352 30.1	50.7	166 19.9	42.6
A 14	16 55.0	65 43.9	42.4	33 36.5	13.1	7 32.0	50.9	181 22.5	42.5
Y 15	31 57.5	80 43.3	41.8	48 37.1	12.4	22 33.9	51.2	196 25.2	42.4
16	46 59.9	95 42.8	41.1	63 37.7	11.6	37 35.8	51.4	211 27.8	42.3
17	62 02.4	110 42.2	40.5	78 38.3	10.9	52 37.8	51.6	226 30.4	42.3
18	77 04.9	125 41.6	S17 39.9	93 39.0	S 8 10.1	67 39.7	N 2 51.9	241 33.0	S 3 42.2
19	92 07.3	140 41.0	39.2	108 39.6	09.3	82 41.6	52.1	256 35.6	42.1
20	107 09.8	155 40.4	38.6	123 40.2	08.6	97 43.5	52.3	271 38.2	42.1
21	122 12.3	170 39.8	38.0	138 40.8	07.8	112 45.5	52.6	286 40.8	42.0
22	137 14.7	185 39.2	37.3	153 41.5	07.1	127 47.4	52.8	301 43.4	41.9
23	152 17.2	200 38.7	36.7	168 42.1	06.3	142 49.3	53.0	316 46.0	41.9
10 00	167 19.6	215 38.1	S17 36.1	183 42.7	S 8 05.5	157 51.2	N 2 53.3	331 48.7	S 3 41.8
01	182 22.1	230 37.5	35.4	198 43.4	04.8	172 53.2	53.5	346 51.3	41.7
02	197 24.6	245 36.9	34.8	213 44.0	04.0	187 55.1	53.7	1 53.9	41.7
03	212 27.0	260 36.3	34.2	228 44.6	03.3	202 57.0	54.0	16 56.5	41.6
04	227 29.5	275 35.7	33.5	243 45.2	02.5	217 58.9	54.2	31 59.1	41.5
05	242 32.0	290 35.1	32.9	258 45.9	01.7	233 00.9	54.4	47 01.7	41.5
06	257 34.4	305 34.6	S17 32.3	273 46.5	S 8 01.0	248 02.8	N 2 54.7	62 04.3	S 3 41.4
07	272 36.9	320 34.0	31.6	288 47.1	8 00.2	263 04.7	54.9	77 06.9	41.3
T 08	287 39.4	335 33.4	31.0	303 47.8	7 59.5	278 06.6	55.1	92 09.6	41.3
H 09	302 41.8	350 32.8	30.3	318 48.4	58.7	293 08.6	55.4	107 12.2	41.2
U 10	317 44.3	5 32.2	29.7	333 49.0	57.9	308 10.5	55.6	122 14.8	41.1
R 11	332 46.8	20 31.7	29.0	348 49.6	57.2	323 12.4	55.8	137 17.4	41.0
S 12	347 49.2	35 31.1	S17 28.4	3 50.3	S 7 56.4	338 14.3	N 2 56.1	152 20.0	S 3 41.0
D 13	2 51.7	50 30.5	27.8	18 50.9	55.7	353 16.3	56.3	167 22.6	40.9
A 14	17 54.1	65 29.9	27.1	33 51.5	54.9	8 18.2	56.5	182 25.2	40.8
Y 15	32 56.6	80 29.3	26.5	48 52.2	54.1	23 20.1	56.8	197 27.8	40.8
16	47 59.1	95 28.7	25.8	63 52.8	53.4	38 22.0	57.0	212 30.5	40.7
17	63 01.5	110 28.2	25.2	78 53.4	52.6	53 24.0	57.2	227 33.1	40.6
18	78 04.0	125 27.6	S17 24.5	93 54.1	S 7 51.9	68 25.9	N 2 57.5	242 35.7	S 3 40.6
19	93 06.5	140 27.0	23.9	108 54.7	51.1	83 27.8	57.7	257 38.3	40.5
20	108 08.9	155 26.4	23.2	123 55.3	50.3	98 29.7	57.9	272 40.9	40.4
21	123 11.4	170 25.9	22.6	138 56.0	49.6	113 31.6	58.2	287 43.5	40.4
22	138 13.9	185 25.3	21.9	153 56.6	48.8	128 33.6	58.4	302 46.1	40.3
23	153 16.3	200 24.7	21.2	168 57.2	48.0	143 35.5	58.6	317 48.8	40.2
	h m								
Mer. Pass.	12 52.5	v −0.6	d 0.6	v 0.6	d 0.8	v 1.9	d 0.2	v 2.6	d 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.8
Achernar	335 28.3	S57 10.9
Acrux	173 10.6	S63 09.7
Adhara	255 13.6	S28 59.5
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.5	N55 53.6
Alkaid	152 59.7	N49 15.1
Al Na'ir	27 46.1	S46 54.3
Alnilam	275 48.0	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.2	N26 40.3
Alpheratz	357 45.6	N29 09.2
Altair	62 10.0	N 8 53.8
Ankaa	353 17.6	S42 14.8
Antares	112 28.2	S26 27.4
Arcturus	145 56.9	N19 07.2
Atria	107 31.5	S69 02.6
Avior	234 18.3	S59 33.1
Bellatrix	278 33.7	N 6 21.5
Betelgeuse	271 03.0	N 7 24.4
Canopus	263 56.7	S52 42.5
Capella	280 36.8	N46 00.7
Deneb	49 33.0	N45 19.1
Denebola	182 35.0	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.9	N61 41.3
Elnath	278 14.6	N28 37.0
Eltanin	90 47.0	N51 28.9
Enif	33 49.0	N 9 55.5
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.3	S57 10.6
Gienah	175 53.7	S17 36.5
Hadar	148 49.8	S60 25.6
Hamal	328 02.9	N23 31.0
Kaus Aust.	83 46.1	S34 22.6
Kochab	137 19.1	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.2	S36 25.5
Miaplacidus	221 39.4	S69 46.1
Mirfak	308 42.9	N49 54.2
Nunki	76 00.5	S26 16.9
Peacock	53 22.1	S56 41.7
Pollux	243 29.5	N27 59.9
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.0	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.6	S 8 11.5
Rigil Kent.	139 53.6	S60 52.8
Sabik	102 14.4	S15 44.3
Schedar	349 43.0	N56 36.1
Shaula	96 24.2	S37 06.6
Sirius	258 35.0	S16 44.2
Spica	158 32.7	S11 13.4
Suhail	222 53.3	S43 29.0
Vega	80 40.2	N38 47.4
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	49 31.7	9 37
Mars	17 07.2	11 46
Jupiter	350 44.5	13 30
Saturn	164 25.5	1 57

UT	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise			
	GHA	Dec	GHA	v	Dec	d	HP		Naut.	Civil		8	9	10	11
d h	° ′	° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
8 00	177 15.4	S 5 06.5	147 36.0	15.0	N12 32.7	10.4	54.1	N 72	04 30	05 50	06 57	05 11	04 20		
01	192 15.5	05.5	162 10.0	15.0	12 43.1	10.2	54.1	N 70	04 40	05 51	06 52	05 36	05 11	03 40	
02	207 15.7	04.5	176 44.0	14.9	12 53.3	10.3	54.1	68	04 47	05 52	06 48	05 55	05 43	05 25	
03	222 15.8	. . 03.5	191 17.9	14.9	13 03.6	10.1	54.1	66	04 53	05 53	06 44	06 10	06 07	06 04	06 04
04	237 16.0	02.6	205 51.8	14.8	13 13.7	10.2	54.1	64	04 59	05 54	06 41	06 22	06 25	06 32	06 45
05	252 16.1	01.6	220 25.6	14.8	13 23.9	10.0	54.1	62	05 03	05 54	06 38	06 33	06 41	06 53	07 13
06	267 16.3	S 5 00.6	234 59.4	14.8	N13 33.9	10.1	54.1	60	05 06	05 55	06 36	06 42	06 54	07 10	07 35
07	282 16.4	4 59.6	249 33.2	14.7	13 44.0	9.9	54.1	N 58	05 09	05 55	06 34	06 50	07 05	07 25	07 53
T 08	297 16.6	58.7	264 06.9	14.6	13 53.9	9.9	54.1	56	05 12	05 55	06 32	06 57	07 15	07 37	08 08
U 09	312 16.7	. . 57.7	278 40.5	14.6	14 03.8	9.9	54.1	54	05 14	05 55	06 30	07 04	07 23	07 48	08 21
E 10	327 16.9	56.7	293 14.1	14.5	14 13.7	9.8	54.2	52	05 16	05 55	06 29	07 10	07 31	07 58	08 32
S 11	342 17.0	55.7	307 47.6	14.5	14 23.5	9.7	54.2	50	05 18	05 55	06 28	07 15	07 38	08 07	08 42
D 12	357 17.2	S 4 54.8	322 21.1	14.5	N14 33.2	9.7	54.2	45	05 21	05 55	06 24	07 26	07 53	08 25	09 04
A 13	12 17.3	53.8	336 54.6	14.4	14 42.9	9.7	54.2	N 40	05 24	05 55	06 22	07 36	08 06	08 40	09 21
Y 14	27 17.5	52.8	351 28.0	14.3	14 52.6	9.5	54.2	35	05 25	05 54	06 20	07 44	08 16	08 53	09 35
15	42 17.7	. . 51.8	6 01.3	14.3	15 02.1	9.5	54.2	30	05 26	05 54	06 17	07 51	08 26	09 04	09 48
16	57 17.8	50.9	20 34.6	14.2	15 11.6	9.5	54.2	20	05 26	05 52	06 14	08 03	08 42	09 24	10 10
17	72 18.0	49.9	35 07.8	14.2	15 21.1	9.4	54.2	N 10	05 25	05 50	06 11	08 14	08 56	09 40	10 28
18	87 18.1	S 4 48.9	49 41.0	14.2	N15 30.5	9.3	54.2	0	05 23	05 47	06 07	08 25	09 09	09 56	10 46
19	102 18.3	47.9	64 14.2	14.0	15 39.8	9.3	54.2	S 10	05 18	05 43	06 04	08 35	09 23	10 12	11 04
20	117 18.4	47.0	78 47.2	14.1	15 49.1	9.2	54.3	20	05 12	05 38	06 00	08 46	09 37	10 29	11 23
21	132 18.6	. . 46.0	93 20.3	13.9	15 58.3	9.1	54.3	30	05 04	05 32	05 56	08 59	09 53	10 49	11 45
22	147 18.7	45.0	107 53.2	13.9	16 07.4	9.1	54.3	35	04 58	05 28	05 54	09 06	10 03	11 00	11 58
23	162 18.9	44.0	122 26.1	13.9	16 16.5	9.0	54.3	40	04 51	05 23	05 51	09 15	10 14	11 14	12 12
9 00	177 19.0	S 4 43.1	136 59.0	13.8	N16 25.5	8.9	54.3	45	04 42	05 18	05 47	09 25	10 27	11 30	12 30
01	192 19.2	42.1	151 31.8	13.7	16 34.4	8.9	54.3	S 50	04 31	05 10	05 43	09 37	10 43	11 49	12 52
02	207 19.3	41.1	166 04.5	13.7	16 43.3	8.8	54.3	52	04 26	05 07	05 41	09 43	10 51	11 58	13 03
03	222 19.5	. . 40.1	180 37.2	13.7	16 52.1	8.7	54.3	54	04 19	05 03	05 39	09 49	10 59	12 09	13 15
04	237 19.6	39.2	195 09.9	13.5	17 00.8	8.7	54.4	56	04 12	04 59	05 37	09 56	11 09	12 20	13 28
05	252 19.8	38.2	209 42.4	13.5	17 09.5	8.6	54.4	58	04 04	04 54	05 35	10 04	11 19	12 34	13 44
06	267 20.0	S 4 37.2	224 14.9	13.5	N17 18.1	8.5	54.4	S 60	03 55	04 49	05 32	10 13	11 32	12 50	14 04
W 07	282 20.1	36.2	238 47.4	13.4	17 26.6	8.5	54.4								
E 08	297 20.3	35.2	253 19.8	13.3	17 35.1	8.4	54.4								
D 09	312 20.4	. . 34.3	267 52.1	13.3	17 43.5	8.3	54.4								
N 10	327 20.6	33.3	282 24.4	13.2	17 51.8	8.2	54.4								
E 11	342 20.7	32.3	296 56.6	13.2	18 00.0	8.2	54.5								
S 12	357 20.9	S 4 31.3	311 28.8	13.0	N18 08.2	8.1	54.5								
D 13	12 21.0	30.4	326 00.8	13.1	18 16.3	8.0	54.5								
A 14	27 21.2	29.4	340 32.9	12.9	18 24.3	7.9	54.5								
Y 15	42 21.4	. . 28.4	355 04.8	13.0	18 32.2	7.9	54.5								
16	57 21.5	27.4	9 36.8	12.8	18 40.1	7.7	54.5								
17	72 21.7	26.4	24 08.6	12.8	18 47.8	7.7	54.5								
18	87 21.8	S 4 25.5	38 40.4	12.7	N18 55.5	7.6	54.6								
19	102 22.0	24.5	53 12.1	12.7	19 03.1	7.6	54.6								
20	117 22.1	23.5	67 43.8	12.5	19 10.7	7.4	54.6								
21	132 22.3	. . 22.5	82 15.3	12.6	19 18.1	7.4	54.6								
22	147 22.5	21.6	96 46.9	12.4	19 25.5	7.3	54.6								
23	162 22.6	20.6	111 18.3	12.4	19 32.8	7.2	54.6								
10 00	177 22.8	S 4 19.6	125 49.7	12.4	N19 40.0	7.1	54.7								
01	192 22.9	18.6	140 21.1	12.2	19 47.1	7.0	54.7								
02	207 23.1	17.6	154 52.3	12.3	19 54.1	6.9	54.7								
03	222 23.2	. . 16.7	169 23.6	12.1	20 01.0	6.9	54.7								
04	237 23.4	15.7	183 54.7	12.1	20 07.9	6.8	54.7								
05	252 23.6	14.7	198 25.8	12.0	20 14.7	6.6	54.8								
06	267 23.7	S 4 13.7	212 56.8	11.9	N20 21.3	6.6	54.8								
07	282 23.9	12.7	227 27.7	11.9	20 27.9	6.5	54.8								
T 08	297 24.0	11.8	241 58.6	11.8	20 34.4	6.4	54.8								
H 09	312 24.2	. . 10.8	256 29.4	11.8	20 40.8	6.3	54.8								
U 10	327 24.4	09.8	271 00.2	11.7	20 47.1	6.2	54.9								
R 11	342 24.5	08.8	285 30.9	11.6	20 53.3	6.2	54.9								
S 12	357 24.7	S 4 07.8	300 01.5	11.6	N20 59.5	6.0	54.9								
D 13	12 24.8	06.9	314 32.1	11.5	21 05.5	5.9	54.9								
A 14	27 25.0	05.9	329 02.6	11.4	21 11.4	5.8	54.9								
Y 15	42 25.2	. . 04.9	343 33.0	11.4	21 17.2	5.8	55.0								
16	57 25.3	03.9	358 03.4	11.3	21 23.0	5.6	55.0								
17	72 25.5	02.9	12 33.7	11.2	21 28.6	5.6	55.0								
18	87 25.6	S 4 02.0	27 03.9	11.2	N21 34.2	5.4	55.0								
19	102 25.8	01.0	41 34.1	11.1	21 39.6	5.3	55.0								
20	117 26.0	4 00.0	56 04.2	11.0	21 44.9	5.3	55.1								
21	132 26.1	3 59.0	70 34.2	11.0	21 50.2	5.1	55.1								
22	147 26.3	58.0	85 04.2	10.9	21 55.3	5.1	55.1								
23	162 26.4	57.1	99 34.1	10.9	N22 00.4	4.9	55.1								
	SD 16.1	d 1.0	SD	14.8		14.8									

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	8	9	10	11
°	h m	h m	h m	h m	h m	h m	h m
N 72	17 26	18 34	19 55	25 18	01 18		
N 70	17 31	18 32	19 44	24 29	00 29	03 37	
68	17 35	18 31	19 36	23 58	25 52	01 52	
66	17 39	18 30	19 30	23 35	25 13	01 13	02 56
64	17 42	18 29	19 25	23 17	24 47	00 47	02 15
62	17 44	18 28	19 20	23 03	24 26	00 26	01 47
60	17 46	18 28	19 16	22 50	24 09	00 09	01 25
N 58	17 48	18 28	19 13	22 40	23 55	25 08	01 08
56	17 50	18 27	19 11	22 31	23 43	24 53	00 53
54	17 52	18 27	19 08	22 23	23 32	24 40	00 40
52	17 53	18 27	19 06	22 15	23 23	24 29	00 29
50	17 55	18 27	19 04	22 09	23 15	24 19	00 19
45	17 58	18 27	19 01	21 55	22 57	23 59	24 58
N 40	18 00	18 27	18 58	21 43	22 43	23 42	24 40
35	18 02	18 27	18 57	21 34	22 31	23 28	24 24
30	18 04	18 28	18 56	21 25	22 20	23 16	24 11
20	18 08	18 30	18 55	21 11	22 02	22 55	23 49
N 10	18 11	18 32	18 56	20 58	21 46	22 37	23 29
0	18 14	18 35	18 59	20 46	21 32	22 20	23 11
S 10	18 17	18 38	19 03	20 34	21 17	22 03	22 53
20	18 21	18 43	19 08	20 21	21 01	21 45	22 33
30	18 25	18 49	19 17	20 07	20 43	21 24	22 11
35	18 27	18 52	19 22	19 59	20 33	21 12	21 58
40	18 30	18 57	19 29	19 49	20 21	20 58	21 42
45	18 33	19 03	19 38	19 38	20 07	20 42	21 24
S 50	18 37	19 10	19 49	19 25	19 50	20 22	21 02
52	18 39	19 13	19 54	19 19	19 42	20 12	20 51
54	18 41	19 17	20 00	19 12	19 33	20 02	20 39
56	18 43	19 21	20 07	19 04	19 24	19 50	20 25
58	18 45	19 25	20 15	18 56	19 12	19 35	20 09
S 60	18 48	19 31	20 24	18 46	18 59	19 19	19 50

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
8	10 59	10 52	12 11	14 35	02 13	04	12
9	10 44	10 37	12 11	15 20	02 57	05	18
10	10 29	10 22	12 10	16 08	03 44	06	26

UT	ARIES	VENUS −4.0		MARS +1.1		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
11 00	168 18.8	215 24.1	S17 20.6	183 57.8	S 7 47.3	158 37.4	N 2 58.8	332 51.4	S 3 40.1
01	183 21.2	230 23.5	19.9	198 58.5	46.5	173 39.3	59.1	347 54.0	40.1
02	198 23.7	245 23.0	19.3	213 59.1	45.8	188 41.3	59.3	2 56.6	40.0
03	213 26.2	260 22.4 . .	18.6	228 59.7 . .	45.0	203 43.2 . .	59.5	17 59.2 . .	39.9
04	228 28.6	275 21.8	18.0	244 00.4	44.2	218 45.1	2 59.8	33 01.8	39.9
05	243 31.1	290 21.2	17.3	259 01.0	43.5	233 47.0	3 00.0	48 04.4	39.8
06	258 33.6	305 20.7	S17 16.6	274 01.6	S 7 42.7	248 49.0	N 3 00.2	63 07.1	S 3 39.7
07	273 36.0	320 20.1	16.0	289 02.3	41.9	263 50.9	00.5	78 09.7	39.7
08	288 38.5	335 19.5	15.3	304 02.9	41.2	278 52.8	00.7	93 12.3	39.6
F 09	303 41.0	350 18.9 . .	14.7	319 03.5 . .	40.4	293 54.7 . .	00.9	108 14.9 . .	39.5
R 10	318 43.4	5 18.4	14.0	334 04.2	39.7	308 56.7	01.2	123 17.5	39.5
I 11	333 45.9	20 17.8	13.3	349 04.8	38.9	323 58.6	01.4	138 20.1	39.4
D 12	348 48.4	35 17.2	S17 12.7	4 05.4	S 7 38.1	339 00.5	N 3 01.6	153 22.7	S 3 39.3
A 13	3 50.8	50 16.6	12.0	19 06.1	37.4	354 02.4	01.9	168 25.4	39.2
Y 14	18 53.3	65 16.1	11.3	34 06.7	36.6	9 04.3	02.1	183 28.0	39.2
15	33 55.7	80 15.5 . .	10.7	49 07.3 . .	35.8	24 06.3 . .	02.3	198 30.6 . .	39.1
16	48 58.2	95 14.9	10.0	64 08.0	35.1	39 08.2	02.6	213 33.2	39.0
17	64 00.7	110 14.3	09.3	79 08.6	34.3	54 10.1	02.8	228 35.8	39.0
18	79 03.1	125 13.8	S17 08.7	94 09.2	S 7 33.5	69 12.0	N 3 03.0	243 38.4	S 3 38.9
19	94 05.6	140 13.2	08.0	109 09.9	32.8	84 14.0	03.3	258 41.0	38.8
20	109 08.1	155 12.6	07.3	124 10.5	32.0	99 15.9	03.5	273 43.7	38.8
21	124 10.5	170 12.0 . .	06.6	139 11.1 . .	31.3	114 17.8 . .	03.7	288 46.3 . .	38.7
22	139 13.0	185 11.5	06.0	154 11.8	30.5	129 19.7	04.0	303 48.9	38.6
23	154 15.5	200 10.9	05.3	169 12.4	29.7	144 21.6	04.2	318 51.5	38.5
12 00	169 17.9	215 10.3	S17 04.6	184 13.0	S 7 29.0	159 23.6	N 3 04.5	333 54.1	S 3 38.5
01	184 20.4	230 09.8	03.9	199 13.7	28.2	174 25.5	04.7	348 56.7	38.4
02	199 22.9	245 09.2	03.3	214 14.3	27.4	189 27.4	04.9	3 59.4	38.3
03	214 25.3	260 08.6 . .	02.6	229 14.9 . .	26.7	204 29.3 . .	05.2	19 02.0 . .	38.3
04	229 27.8	275 08.1	01.9	244 15.6	25.9	219 31.3	05.4	34 04.6	38.2
05	244 30.2	290 07.5	01.2	259 16.2	25.1	234 33.2	05.6	49 07.2	38.1
06	259 32.7	305 06.9	S17 00.5	274 16.8	S 7 24.4	249 35.1	N 3 05.9	64 09.8	S 3 38.1
07	274 35.2	320 06.3	16 59.9	289 17.5	23.6	264 37.0	06.1	79 12.4	38.0
S 08	289 37.6	335 05.8	59.2	304 18.1	22.8	279 38.9	06.3	94 15.1	37.9
A 09	304 40.1	350 05.2 . .	58.5	319 18.8 . .	22.1	294 40.9 . .	06.6	109 17.7 . .	37.8
T 10	319 42.6	5 04.6	57.8	334 19.4	21.3	309 42.8	06.8	124 20.3	37.8
U 11	334 45.0	20 04.1	57.1	349 20.0	20.5	324 44.7	07.0	139 22.9	37.7
R 12	349 47.5	35 03.5	S16 56.4	4 20.7	S 7 19.8	339 46.6	N 3 07.3	154 25.5	S 3 37.6
D 13	4 50.0	50 02.9	55.8	19 21.3	19.0	354 48.6	07.5	169 28.1	37.6
A 14	19 52.4	65 02.4	55.1	34 21.9	18.2	9 50.5	07.7	184 30.8	37.5
Y 15	34 54.9	80 01.8 . .	54.4	49 22.6 . .	17.5	24 52.4 . .	08.0	199 33.4 . .	37.4
16	49 57.3	95 01.2	53.7	64 23.2	16.7	39 54.3	08.2	214 36.0	37.4
17	64 59.8	110 00.7	53.0	79 23.8	15.9	54 56.2	08.4	229 38.6	37.3
18	80 02.3	125 00.1	S16 52.3	94 24.5	S 7 15.2	69 58.2	N 3 08.7	244 41.2	S 3 37.2
19	95 04.7	139 59.5	51.6	109 25.1	14.4	85 00.1	08.9	259 43.9	37.1
20	110 07.2	154 59.0	50.9	124 25.8	13.6	100 02.0	09.1	274 46.5	37.1
21	125 09.7	169 58.4 . .	50.2	139 26.4 . .	12.9	115 03.9 . .	09.4	289 49.1 . .	37.0
22	140 12.1	184 57.9	49.5	154 27.0	12.1	130 05.8	09.6	304 51.7	36.9
23	155 14.6	199 57.3	48.8	169 27.7	11.3	145 07.8	09.8	319 54.3	36.9
13 00	170 17.1	214 56.7	S16 48.1	184 28.3	S 7 10.6	160 09.7	N 3 10.1	334 56.9	S 3 36.8
01	185 19.5	229 56.2	47.4	199 28.9	09.8	175 11.6	10.3	349 59.6	36.7
02	200 22.0	244 55.6	46.7	214 29.6	09.0	190 13.5	10.5	5 02.2	36.7
03	215 24.5	259 55.0 . .	46.1	229 30.2 . .	08.3	205 15.5 . .	10.8	20 04.8 . .	36.6
04	230 26.9	274 54.5	45.4	244 30.9	07.5	220 17.4	11.0	35 07.4	36.5
05	245 29.4	289 53.9	44.7	259 31.5	06.7	235 19.3	11.2	50 10.0	36.4
06	260 31.8	304 53.3	S16 44.0	274 32.1	S 7 06.0	250 21.2	N 3 11.5	65 12.7	S 3 36.4
07	275 34.3	319 52.8	43.3	289 32.8	05.2	265 23.1	11.7	80 15.3	36.3
08	290 36.8	334 52.2	42.5	304 33.4	04.4	280 25.1	11.9	95 17.9	36.2
S 09	305 39.2	349 51.7 . .	41.8	319 34.1 . .	03.7	295 27.0 . .	12.2	110 20.5 . .	36.2
U 10	320 41.7	4 51.1	41.1	334 34.7	02.9	310 28.9	12.4	125 23.1	36.1
N 11	335 44.2	19 50.5	40.4	349 35.3	02.1	325 30.8	12.6	140 25.8	36.0
D 12	350 46.6	34 50.0	S16 39.7	4 36.0	S 7 01.4	340 32.7	N 3 12.9	155 28.4	S 3 35.9
A 13	5 49.1	49 49.4	39.0	19 36.6	7 00.6	355 34.7	13.1	170 31.0	35.9
Y 14	20 51.6	64 48.9	38.3	34 37.2	6 59.8	10 36.6	13.3	185 33.6	35.8
15	35 54.0	79 48.3 . .	37.6	49 37.9 . .	59.1	25 38.5 . .	13.6	200 36.2 . .	35.7
16	50 56.5	94 47.7	36.9	64 38.5	58.3	40 40.4	13.8	215 38.8	35.7
17	65 59.0	109 47.2	36.2	79 39.2	57.5	55 42.3	14.0	230 41.5	35.6
18	81 01.4	124 46.6	S16 35.5	94 39.8	S 6 56.8	70 44.3	N 3 14.3	245 44.1	S 3 35.5
19	96 03.9	139 46.1	34.8	109 40.4	56.0	85 46.2	14.5	260 46.7	35.4
20	111 06.3	154 45.5	34.1	124 41.1	55.2	100 48.1	14.7	275 49.3	35.4
21	126 08.8	169 45.0 . .	33.3	139 41.7 . .	54.4	115 50.0 . .	15.0	290 51.9 . .	35.3
22	141 11.3	184 44.4	32.6	154 42.4	53.7	130 51.9	15.2	305 54.6	35.2
23	156 13.7	199 43.8	31.9	169 43.0	52.9	145 53.9	15.4	320 57.2	35.2
	h m								
Mer. Pass.	12 40.7	*v* −0.6	*d* 0.7	*v* 0.6	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.8
Achernar	335 28.3	S57 10.9
Acrux	173 10.6	S63 09.8
Adhara	255 13.7	S28 59.6
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.5	N55 53.7
Alkaid	152 59.7	N49 15.1
Al Na'ir	27 46.1	S46 54.3
Alnilam	275 48.0	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.2	N26 40.3
Alpheratz	357 45.6	N29 09.2
Altair	62 10.0	N 8 53.8
Ankaa	353 17.6	S42 14.8
Antares	112 28.2	S26 27.4
Arcturus	145 56.9	N19 07.2
Atria	107 31.4	S69 02.6
Avior	234 18.3	S59 33.1
Bellatrix	278 33.7	N 6 21.5
Betelgeuse	271 03.0	N 7 24.4
Canopus	263 56.7	S52 42.5
Capella	280 36.9	N46 00.7
Deneb	49 33.0	N45 19.1
Denebola	182 35.0	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.9	N61 41.3
Elnath	278 14.7	N28 37.0
Eltanin	90 47.0	N51 28.9
Enif	33 49.0	N 9 55.5
Fomalhaut	15 26.1	S29 33.8
Gacrux	172 02.3	S57 10.7
Gienah	175 53.7	S17 36.5
Hadar	148 49.8	S60 25.6
Hamal	328 02.9	N23 31.0
Kaus Aust.	83 46.0	S34 22.6
Kochab	137 19.0	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.4	S69 46.1
Mirfak	308 43.0	N49 54.2
Nunki	76 00.4	S26 16.9
Peacock	53 22.1	S56 41.7
Pollux	243 29.5	N27 59.9
Procyon	245 01.2	N 5 11.6
Rasalhague	96 08.0	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.6	S 8 11.5
Rigil Kent.	139 53.6	S60 52.8
Sabik	102 14.4	S15 44.3
Schedar	349 43.0	N56 36.0
Shaula	96 24.1	S37 06.6
Sirius	258 35.0	S16 44.2
Spica	158 32.7	S11 13.4
Suhail	222 53.3	S43 29.0
Vega	80 40.2	N38 47.4
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	45 52.4	9 40
Mars	14 55.1	11 43
Jupiter	350 05.6	13 21
Saturn	164 36.2	1 44

2011 MARCH 11, 12, 13 (FRI., SAT., SUN.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
11 00	177 26.6	S 3 56.1	114 04.0	10.8	N22 05.3	4.8	55.2
01	192 26.8	55.1	128 33.8	10.7	22 10.1	4.7	55.2
02	207 26.9	54.1	143 03.5	10.6	22 14.8	4.6	55.2
03	222 27.1	. . 53.1	157 33.1	10.6	22 19.4	4.6	55.2
04	237 27.3	52.2	172 02.7	10.6	22 24.0	4.4	55.3
05	252 27.4	51.2	186 32.3	10.4	22 28.4	4.3	55.3
06	267 27.6	S 3 50.2	201 01.7	10.5	N22 32.7	4.1	55.3
07	282 27.7	49.2	215 31.2	10.3	22 36.8	4.1	55.3
08	297 27.9	48.2	230 00.5	10.3	22 40.9	4.0	55.4
F 09	312 28.1	. . 47.2	244 29.8	10.2	22 44.9	3.8	55.4
R 10	327 28.2	46.3	258 59.0	10.2	22 48.7	3.8	55.4
I 11	342 28.4	45.3	273 28.2	10.1	22 52.5	3.6	55.4
D 12	357 28.6	S 3 44.3	287 57.3	10.0	N22 56.1	3.5	55.5
A 13	12 28.7	43.3	302 26.3	10.0	22 59.6	3.4	55.5
Y 14	27 28.9	42.3	316 55.3	9.9	23 03.0	3.3	55.5
15	42 29.0	. . 41.4	331 24.2	9.9	23 06.3	3.2	55.5
16	57 29.2	40.4	345 53.1	9.8	23 09.5	3.0	55.6
17	72 29.4	39.4	0 21.9	9.8	23 12.5	3.0	55.6
18	87 29.5	S 3 38.4	14 50.7	9.7	N23 15.5	2.8	55.6
19	102 29.7	37.4	29 19.4	9.6	23 18.3	2.7	55.7
20	117 29.9	36.4	43 48.0	9.6	23 21.0	2.6	55.7
21	132 30.0	. . 35.5	58 16.6	9.5	23 23.6	2.4	55.7
22	147 30.2	34.5	72 45.1	9.5	23 26.0	2.4	55.7
23	162 30.4	33.5	87 13.6	9.4	23 28.4	2.2	55.8
12 00	177 30.5	S 3 32.5	101 42.0	9.4	N23 30.6	2.1	55.8
01	192 30.7	31.5	116 10.4	9.3	23 32.7	2.0	55.8
02	207 30.9	30.5	130 38.7	9.3	23 34.7	1.9	55.9
03	222 31.0	. . 29.6	145 07.0	9.2	23 36.6	1.7	55.9
04	237 31.2	28.6	159 35.2	9.1	23 38.3	1.6	55.9
05	252 31.3	27.6	174 03.3	9.1	23 39.9	1.5	56.0
06	267 31.5	S 3 26.6	188 31.4	9.1	N23 41.4	1.4	56.0
S 07	282 31.7	25.6	202 59.5	9.0	23 42.8	1.2	56.0
A 08	297 31.8	24.7	217 27.5	9.0	23 44.0	1.1	56.0
T 09	312 32.0	. . 23.7	231 55.5	8.9	23 45.1	1.0	56.1
U 10	327 32.2	22.7	246 23.4	8.8	23 46.1	0.8	56.1
R 11	342 32.3	21.7	260 51.2	8.9	23 46.9	0.8	56.1
D 12	357 32.5	S 3 20.7	275 19.1	8.7	N23 47.7	0.6	56.2
A 13	12 32.7	19.7	289 46.8	8.8	23 48.3	0.4	56.2
Y 14	27 32.8	18.7	304 14.6	8.7	23 48.7	0.4	56.2
15	42 33.0	. . 17.8	318 42.3	8.6	23 49.1	0.2	56.3
16	57 33.2	16.8	333 09.9	8.6	23 49.3	0.1	56.3
17	72 33.3	15.8	347 37.5	8.6	23 49.4	0.1	56.3
18	87 33.5	S 3 14.8	2 05.1	8.5	N23 49.3	0.2	56.4
19	102 33.7	13.8	16 32.6	8.5	23 49.1	0.3	56.4
20	117 33.8	12.8	31 00.1	8.4	23 48.8	0.4	56.4
21	132 34.0	. . 11.9	45 27.5	8.4	23 48.4	0.6	56.5
22	147 34.2	10.9	59 54.9	8.4	23 47.8	0.7	56.5
23	162 34.3	09.9	74 22.3	8.3	23 47.1	0.8	56.5
13 00	177 34.5	S 3 08.9	88 49.6	8.3	N23 46.3	1.0	56.6
01	192 34.7	07.9	103 16.9	8.3	23 45.3	1.1	56.6
02	207 34.9	06.9	117 44.2	8.2	23 44.2	1.3	56.6
03	222 35.0	. . 06.0	132 11.4	8.2	23 42.9	1.4	56.7
04	237 35.2	05.0	146 38.6	8.2	23 41.5	1.5	56.7
05	252 35.4	04.0	161 05.8	8.1	23 40.0	1.6	56.8
06	267 35.5	S 3 03.0	175 32.9	8.1	N23 38.4	1.8	56.8
07	282 35.7	02.0	190 00.0	8.1	23 36.6	1.9	56.8
08	297 35.9	01.0	204 27.1	8.0	23 34.7	2.1	56.9
S 09	312 36.0	3 00.0	218 54.1	8.1	23 32.6	2.2	56.9
U 10	327 36.2	2 59.1	233 21.2	8.0	23 30.4	2.3	56.9
N 11	342 36.4	58.1	247 48.2	7.9	23 28.1	2.5	57.0
D 12	357 36.5	S 2 57.1	262 15.1	8.0	N23 25.6	2.6	57.0
A 13	12 36.7	56.1	276 42.1	7.9	23 23.0	2.7	57.0
Y 14	27 36.9	55.1	291 09.0	7.9	23 20.3	2.9	57.1
15	42 37.1	. . 54.1	305 35.9	7.9	23 17.4	3.0	57.1
16	57 37.2	53.2	320 02.8	7.9	23 14.4	3.2	57.2
17	72 37.4	52.2	334 29.7	7.8	23 11.2	3.3	57.2
18	87 37.6	S 2 51.2	348 56.5	7.8	N23 07.9	3.4	57.2
19	102 37.7	50.2	3 23.3	7.8	23 04.5	3.6	57.3
20	117 37.9	49.2	17 50.1	7.8	23 00.9	3.7	57.3
21	132 38.1	. . 48.2	32 16.9	7.8	22 57.2	3.8	57.3
22	147 38.2	47.2	46 43.7	7.8	22 53.4	4.0	57.4
23	162 38.4	46.3	61 10.5	7.7	N22 49.4	4.1	57.4
	SD 16.1	d 1.0	SD	15.1		15.3	15.5

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 11	Moonrise 12	Moonrise 13	Moonrise 14
°	h m	h m	h m	h m	h m	h m	h m
N 72	04 13	05 35	06 41				
N 70	04 25	05 38	06 38				
68	04 34	05 40	06 35				
66	04 42	05 42	06 33	06 04	06 12	07 11	08 59
64	04 48	05 43	06 31	06 45	07 14	08 12	09 38
62	04 53	05 45	06 29	07 13	07 49	08 46	10 05
60	04 57	05 46	06 27	07 35	08 14	09 11	10 26
N 58	05 01	05 47	06 26	07 53	08 34	09 30	10 43
56	05 04	05 47	06 24	08 08	08 50	09 47	10 57
54	05 07	05 48	06 23	08 21	09 04	10 01	11 10
52	05 09	05 49	06 22	08 32	09 17	10 13	11 21
50	05 12	05 49	06 21	08 42	09 28	10 24	11 30
45	05 16	05 50	06 19	09 04	09 50	10 46	11 51
N 40	05 19	05 50	06 17	09 21	10 09	11 04	12 07
35	05 21	05 50	06 15	09 35	10 24	11 19	12 21
30	05 22	05 50	06 14	09 48	10 37	11 33	12 33
20	05 24	05 49	06 11	10 10	11 00	11 55	12 54
N 10	05 24	05 48	06 09	10 28	11 20	12 15	13 11
0	05 22	05 46	06 07	10 46	11 38	12 33	13 28
S 10	05 19	05 43	06 04	11 04	11 57	12 51	13 45
20	05 14	05 39	06 01	11 23	12 17	13 10	14 02
30	05 06	05 34	05 58	11 45	12 40	13 33	14 23
35	05 01	05 31	05 56	11 58	12 53	13 46	14 35
40	04 55	05 27	05 54	12 12	13 09	14 01	14 48
45	04 47	05 22	05 51	12 30	13 27	14 19	15 04
S 50	04 37	05 16	05 48	12 52	13 51	14 41	15 24
52	04 32	05 13	05 47	13 03	14 02	14 52	15 34
54	04 26	05 09	05 45	13 15	14 14	15 04	15 44
56	04 20	05 06	05 43	13 28	14 29	15 18	15 56
58	04 13	05 01	05 41	13 44	14 46	15 34	16 10
S 60	04 04	04 57	05 39	14 04	15 06	15 54	16 26

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 11	Moonset 12	Moonset 13	Moonset 14
°	h m	h m	h m	h m	h m	h m	h m
N 72	17 40	18 48	20 10				
N 70	17 44	18 44	19 58				
68	17 46	18 42	19 48				
66	17 49	18 40	19 40	02 56	04 35	05 29	05 35
64	17 51	18 38	19 34	02 15	03 33	04 28	04 56
62	17 52	18 37	19 29	01 47	02 59	03 54	04 29
60	17 54	18 35	19 24	01 25	02 34	03 29	04 08
N 58	17 55	18 34	19 20	01 08	02 14	03 09	03 50
56	17 56	18 33	19 17	00 53	01 57	02 52	03 36
54	17 58	18 33	19 14	00 40	01 43	02 38	03 23
52	17 59	18 32	19 11	00 29	01 31	02 26	03 12
50	17 59	18 32	19 09	00 19	01 20	02 15	03 02
45	18 01	18 31	19 05	24 58	00 58	01 52	02 41
N 40	18 03	18 30	19 02	24 40	00 40	01 34	02 24
35	18 05	18 30	18 59	24 24	00 24	01 19	02 09
30	18 06	18 30	18 58	24 11	00 11	01 05	01 57
20	18 09	18 31	18 56	23 49	24 43	00 43	01 35
N 10	18 11	18 32	18 56	23 29	24 23	00 23	01 17
0	18 13	18 34	18 58	23 11	24 04	00 04	00 59
S 10	18 15	18 36	19 01	22 53	23 46	24 42	00 42
20	18 18	18 40	19 06	22 33	23 26	24 23	00 23
30	18 21	18 45	19 13	22 11	23 03	24 01	00 01
35	18 23	18 48	19 18	21 58	22 50	23 48	24 52
40	18 25	18 52	19 24	21 42	22 34	23 33	24 39
45	18 27	18 57	19 32	21 24	22 15	23 16	24 24
S 50	18 30	19 03	19 42	21 02	21 52	22 54	24 05
52	18 32	19 06	19 47	20 51	21 41	22 43	23 56
54	18 33	19 09	19 52	20 39	21 29	22 31	23 46
56	18 35	19 13	19 58	20 25	21 14	22 18	23 34
58	18 37	19 17	20 05	20 09	20 57	22 02	23 21
S 60	18 39	19 21	20 13	19 50	20 36	21 43	23 05

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
11	10 14	10 06	12 10	16 58	04 33	07	35
12	09 58	09 50	12 10	17 51	05 25	08	45
13	09 42	09 34	12 10	18 46	06 18	09	55

UT	ARIES	VENUS −4.0		MARS +1.1		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
14 00	171 16.2	214 43.3	S16 31.2	184 43.6	S 6 52.1	160 55.8	N 3 15.7	335 59.8	S 3 35.1
01	186 18.7	229 42.7	30.5	199 44.3	51.4	175 57.7	15.9	351 02.4	35.0
02	201 21.1	244 42.2	29.8	214 44.9	50.6	190 59.6	16.1	6 05.0	34.9
03	216 23.6	259 41.6	29.0	229 45.6	49.8	206 01.5	16.4	21 07.7	34.9
04	231 26.1	274 41.1	28.3	244 46.2	49.1	221 03.5	16.6	36 10.3	34.8
05	246 28.5	289 40.5	27.6	259 46.9	48.3	236 05.4	16.8	51 12.9	34.7
06	261 31.0	304 40.0	S16 26.9	274 47.5	S 6 47.5	251 07.3	N 3 17.1	66 15.5	S 3 34.7
07	276 33.5	319 39.4	26.2	289 48.1	46.7	266 09.2	17.3	81 18.2	34.6
08	291 35.9	334 38.9	25.4	304 48.8	46.0	281 11.1	17.5	96 20.8	34.5
M 09	306 38.4	349 38.3	24.7	319 49.4	45.2	296 13.1	17.8	111 23.4	34.4
O 10	321 40.8	4 37.7	24.0	334 50.1	44.4	311 15.0	18.0	126 26.0	34.4
N 11	336 43.3	19 37.2	23.3	349 50.7	43.7	326 16.9	18.2	141 28.6	34.3
D 12	351 45.8	34 36.6	S16 22.6	4 51.3	S 6 42.9	341 18.8	N 3 18.5	156 31.3	S 3 34.2
A 13	6 48.2	49 36.1	21.8	19 52.0	42.1	356 20.7	18.7	171 33.9	34.2
Y 14	21 50.7	64 35.5	21.1	34 52.6	41.4	11 22.7	18.9	186 36.5	34.1
15	36 53.2	79 35.0	20.4	49 53.3	40.6	26 24.6	19.2	201 39.1	34.0
16	51 55.6	94 34.4	19.6	64 53.9	39.8	41 26.5	19.4	216 41.7	33.9
17	66 58.1	109 33.9	18.9	79 54.6	39.0	56 28.4	19.6	231 44.4	33.9
18	82 00.6	124 33.3	S16 18.2	94 55.2	S 6 38.3	71 30.3	N 3 19.9	246 47.0	S 3 33.8
19	97 03.0	139 32.8	17.5	109 55.8	37.5	86 32.2	20.1	261 49.6	33.7
20	112 05.5	154 32.2	16.7	124 56.5	36.7	101 34.2	20.4	276 52.2	33.7
21	127 07.9	169 31.7	16.0	139 57.1	36.0	116 36.1	20.6	291 54.9	33.6
22	142 10.4	184 31.1	15.3	154 57.8	35.2	131 38.0	20.8	306 57.5	33.5
23	157 12.9	199 30.6	14.5	169 58.4	34.4	146 39.9	21.1	322 00.1	33.4
15 00	172 15.3	214 30.0	S16 13.8	184 59.1	S 6 33.6	161 41.8	N 3 21.3	337 02.7	S 3 33.4
01	187 17.8	229 29.5	13.1	199 59.7	32.9	176 43.8	21.5	352 05.3	33.3
02	202 20.3	244 28.9	12.3	215 00.3	32.1	191 45.7	21.8	7 08.0	33.2
03	217 22.7	259 28.4	11.6	230 01.0	31.3	206 47.6	22.0	22 10.6	33.2
04	232 25.2	274 27.9	10.8	245 01.6	30.6	221 49.5	22.2	37 13.2	33.1
05	247 27.7	289 27.3	10.1	260 02.3	29.8	236 51.4	22.5	52 15.8	33.0
06	262 30.1	304 26.8	S16 09.4	275 02.9	S 6 29.0	251 53.4	N 3 22.7	67 18.5	S 3 32.9
07	277 32.6	319 26.2	08.6	290 03.6	28.2	266 55.3	22.9	82 21.1	32.9
T 08	292 35.1	334 25.7	07.9	305 04.2	27.5	281 57.2	23.2	97 23.7	32.8
U 09	307 37.5	349 25.1	07.1	320 04.9	26.7	296 59.1	23.4	112 26.3	32.7
E 10	322 40.0	4 24.6	06.4	335 05.5	25.9	312 01.0	23.6	127 28.9	32.7
S 11	337 42.4	19 24.0	05.7	350 06.1	25.1	327 02.9	23.9	142 31.6	32.6
D 12	352 44.9	34 23.5	S16 04.9	5 06.8	S 6 24.4	342 04.9	N 3 24.1	157 34.2	S 3 32.5
A 13	7 47.4	49 22.9	04.2	20 07.4	23.6	357 06.8	24.3	172 36.8	32.4
Y 14	22 49.8	64 22.4	03.4	35 08.1	22.8	12 08.7	24.6	187 39.4	32.4
15	37 52.3	79 21.9	02.7	50 08.7	22.1	27 10.6	24.8	202 42.1	32.3
16	52 54.8	94 21.3	01.9	65 09.4	21.3	42 12.5	25.0	217 44.7	32.2
17	67 57.2	109 20.8	01.2	80 10.0	20.5	57 14.5	25.3	232 47.3	32.2
18	82 59.7	124 20.2	S16 00.4	95 10.7	S 6 19.7	72 16.4	N 3 25.5	247 49.9	S 3 32.1
19	98 02.2	139 19.7	15 59.7	110 11.3	19.0	87 18.3	25.7	262 52.6	32.0
20	113 04.6	154 19.1	58.9	125 12.0	18.2	102 20.2	26.0	277 55.2	31.9
21	128 07.1	169 18.6	58.2	140 12.6	17.4	117 22.1	26.2	292 57.8	31.9
22	143 09.6	184 18.1	57.4	155 13.3	16.6	132 24.0	26.4	308 00.4	31.8
23	158 12.0	199 17.5	56.7	170 13.9	15.9	147 26.0	26.7	323 03.1	31.7
16 00	173 14.5	214 17.0	S15 55.9	185 14.5	S 6 15.1	162 27.9	N 3 26.9	338 05.7	S 3 31.6
01	188 16.9	229 16.4	55.2	200 15.2	14.3	177 29.8	27.1	353 08.3	31.6
02	203 19.4	244 15.9	54.4	215 15.8	13.5	192 31.7	27.4	8 10.9	31.5
03	218 21.9	259 15.4	53.6	230 16.5	12.8	207 33.6	27.6	23 13.6	31.4
04	233 24.3	274 14.8	52.9	245 17.1	12.0	222 35.5	27.8	38 16.2	31.4
05	248 26.8	289 14.3	52.1	260 17.8	11.2	237 37.5	28.1	53 18.8	31.3
06	263 29.3	304 13.7	S15 51.4	275 18.4	S 6 10.4	252 39.4	N 3 28.3	68 21.4	S 3 31.2
W 07	278 31.7	319 13.2	50.6	290 19.1	09.7	267 41.3	28.5	83 24.1	31.1
E 08	293 34.2	334 12.7	49.9	305 19.7	08.9	282 43.2	28.8	98 26.7	31.1
D 09	308 36.7	349 12.1	49.1	320 20.4	08.1	297 45.1	29.0	113 29.3	31.0
N 10	323 39.1	4 11.6	48.3	335 21.0	07.3	312 47.0	29.3	128 31.9	30.9
E 11	338 41.6	19 11.0	47.6	350 21.7	06.6	327 49.0	29.5	143 34.6	30.8
S 12	353 44.1	34 10.5	S15 46.8	5 22.3	S 6 05.8	342 50.9	N 3 29.7	158 37.2	S 3 30.8
D 13	8 46.5	49 10.0	46.0	20 23.0	05.0	357 52.8	30.0	173 39.8	30.7
A 14	23 49.0	64 09.4	45.3	35 23.6	04.3	12 54.7	30.2	188 42.4	30.6
Y 15	38 51.4	79 08.9	44.5	50 24.3	03.5	27 56.6	30.4	203 45.1	30.6
16	53 53.9	94 08.4	43.7	65 24.9	02.7	42 58.5	30.7	218 47.7	30.5
17	68 56.4	109 07.8	43.0	80 25.6	01.9	58 00.5	30.9	233 50.3	30.4
18	83 58.8	124 07.3	S15 42.2	95 26.2	S 6 01.2	73 02.4	N 3 31.1	248 52.9	S 3 30.3
19	99 01.3	139 06.8	41.4	110 26.9	6 00.4	88 04.3	31.4	263 55.6	30.3
20	114 03.8	154 06.2	40.7	125 27.5	5 59.6	103 06.2	31.6	278 58.2	30.2
21	129 06.2	169 05.7	39.9	140 28.1	58.8	118 08.1	31.8	294 00.8	30.1
22	144 08.7	184 05.2	39.1	155 28.8	58.0	133 10.0	32.1	309 03.4	30.0
23	159 11.2	199 04.6	38.4	170 29.4	57.3	148 12.0	32.3	324 06.1	30.0
	h m								
Mer. Pass.	12 28.9	*v* −0.5	*d* 0.7	*v* 0.6	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.8
Achernar	335 28.3	S57 10.9
Acrux	173 10.5	S63 09.8
Adhara	255 13.7	S28 59.6
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.4	N55 53.7
Alkaid	152 59.7	N49 15.1
Al Na'ir	27 46.1	S46 54.3
Alnilam	275 48.0	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.2	N26 40.3
Alpheratz	357 45.6	N29 09.2
Altair	62 10.0	N 8 53.8
Ankaa	353 17.6	S42 14.7
Antares	112 28.1	S26 27.4
Arcturus	145 56.9	N19 07.2
Atria	107 31.4	S69 02.6
Avior	234 18.3	S59 33.1
Bellatrix	278 33.7	N 6 21.5
Betelgeuse	271 03.0	N 7 24.4
Canopus	263 56.8	S52 42.5
Capella	280 36.9	N46 00.7
Deneb	49 32.9	N45 19.1
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.9	N61 41.3
Elnath	278 14.7	N28 37.0
Eltanin	90 46.9	N51 28.9
Enif	33 49.0	N 9 55.5
Fomalhaut	15 26.1	S29 33.7
Gacrux	172 02.2	S57 10.7
Gienah	175 53.6	S17 36.5
Hadar	148 49.8	S60 25.6
Hamal	328 02.9	N23 31.0
Kaus Aust.	83 46.0	S34 22.6
Kochab	137 19.0	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.4	S69 46.1
Mirfak	308 43.0	N49 54.2
Nunki	76 00.4	S26 16.9
Peacock	53 22.1	S56 41.7
Pollux	243 29.5	N27 59.9
Procyon	245 01.2	N 5 11.6
Rasalhague	96 07.9	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.6	S 8 11.5
Rigil Kent.	139 53.5	S60 52.8
Sabik	102 14.3	S15 44.4
Schedar	349 43.0	N56 36.0
Shaula	96 24.1	S37 06.6
Sirius	258 35.0	S16 44.2
Spica	158 32.7	S11 13.4
Suhail	222 53.3	S43 29.0
Vega	80 40.2	N38 47.4
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	42 14.7	9 42
Mars	12 43.7	11 40
Jupiter	349 26.5	13 12
Saturn	164 47.4	1 32

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
14 00	177 38.6	S 2 45.3	75 37.2	7.7	N22 45.3	4.3	57.5
01	192 38.8	44.3	90 03.9	7.8	22 41.0	4.4	57.5
02	207 38.9	43.3	104 30.7	7.7	22 36.6	4.5	57.5
03	222 39.1	. . 42.3	118 57.4	7.7	22 32.1	4.7	57.6
04	237 39.3	41.3	133 24.1	7.7	22 27.4	4.8	57.6
05	252 39.4	40.3	147 50.8	7.7	22 22.6	5.0	57.7
06	267 39.6	S 2 39.4	162 17.5	7.6	N22 17.6	5.0	57.7
07	282 39.8	38.4	176 44.1	7.7	22 12.6	5.3	57.7
08	297 40.0	37.4	191 10.8	7.7	22 07.3	5.3	57.8
M 09	312 40.1	. . 36.4	205 37.5	7.6	22 02.0	5.5	57.8
O 10	327 40.3	35.4	220 04.1	7.7	21 56.5	5.7	57.9
N 11	342 40.5	34.4	234 30.8	7.6	21 50.8	5.7	57.9
D 12	357 40.7	S 2 33.4	248 57.4	7.7	N21 45.1	5.9	57.9
A 13	12 40.8	32.5	263 24.1	7.6	21 39.2	6.1	58.0
Y 14	27 41.0	31.5	277 50.7	7.7	21 33.1	6.2	58.0
15	42 41.2	. . 30.5	292 17.4	7.6	21 26.9	6.3	58.1
16	57 41.3	29.5	306 44.0	7.7	21 20.6	6.4	58.1
17	72 41.5	28.5	321 10.7	7.6	21 14.2	6.6	58.1
18	87 41.7	S 2 27.5	335 37.3	7.7	N21 07.6	6.8	58.2
19	102 41.9	26.5	350 04.0	7.6	21 00.8	6.8	58.2
20	117 42.0	25.6	4 30.6	7.7	20 54.0	7.0	58.3
21	132 42.2	. . 24.6	18 57.3	7.6	20 47.0	7.1	58.3
22	147 42.4	23.6	33 23.9	7.7	20 39.9	7.3	58.3
23	162 42.6	22.6	47 50.6	7.7	20 32.6	7.4	58.4
15 00	177 42.7	S 2 21.6	62 17.3	7.7	N20 25.2	7.5	58.4
01	192 42.9	20.6	76 44.0	7.6	20 17.7	7.7	58.5
02	207 43.1	19.6	91 10.6	7.7	20 10.0	7.7	58.5
03	222 43.3	. . 18.6	105 37.3	7.7	20 02.3	8.0	58.5
04	237 43.4	17.7	120 04.0	7.7	19 54.3	8.0	58.6
05	252 43.6	16.7	134 30.7	7.8	19 46.3	8.2	58.6
06	267 43.8	S 2 15.7	148 57.5	7.7	N19 38.1	8.3	58.7
07	282 44.0	14.7	163 24.2	7.7	19 29.8	8.4	58.7
T 08	297 44.1	13.7	177 50.9	7.8	19 21.4	8.6	58.7
U 09	312 44.3	. . 12.7	192 17.7	7.7	19 12.8	8.7	58.8
E 10	327 44.5	11.7	206 44.4	7.8	19 04.1	8.8	58.8
S 11	342 44.7	10.8	221 11.2	7.8	18 55.3	8.9	58.9
D 12	357 44.8	S 2 09.8	235 38.0	7.8	N18 46.4	9.1	58.9
A 13	12 45.0	08.8	250 04.8	7.8	18 37.3	9.2	58.9
Y 14	27 45.2	07.8	264 31.6	7.8	18 28.1	9.3	59.0
15	42 45.4	. . 06.8	278 58.4	7.8	18 18.8	9.5	59.0
16	57 45.5	05.8	293 25.2	7.9	18 09.3	9.5	59.1
17	72 45.7	04.8	307 52.1	7.8	17 59.8	9.7	59.1
18	87 45.9	S 2 03.8	322 18.9	7.9	N17 50.1	9.8	59.1
19	102 46.1	02.9	336 45.8	7.9	17 40.3	10.0	59.2
20	117 46.2	01.9	351 12.7	7.9	17 30.3	10.0	59.2
21	132 46.4	2 00.9	5 39.6	7.9	17 20.3	10.2	59.3
22	147 46.6	1 59.9	20 06.5	8.0	17 10.1	10.2	59.3
23	162 46.8	58.9	34 33.5	7.9	16 59.9	10.4	59.3
16 00	177 46.9	S 1 57.9	49 00.4	8.0	N16 49.5	10.6	59.4
01	192 47.1	56.9	63 27.4	8.0	16 38.9	10.6	59.4
02	207 47.3	55.9	77 54.4	8.0	16 28.3	10.7	59.5
03	222 47.5	. . 55.0	92 21.4	8.0	16 17.6	10.9	59.5
04	237 47.6	54.0	106 48.4	8.1	16 06.7	11.0	59.5
05	252 47.8	53.0	121 15.5	8.0	15 55.7	11.0	59.6
06	267 48.0	S 1 52.0	135 42.5	8.1	N15 44.7	11.2	59.6
W 07	282 48.2	51.0	150 09.6	8.1	15 33.5	11.3	59.6
E 08	297 48.4	50.0	164 36.7	8.1	15 22.2	11.4	59.7
D 09	312 48.5	. . 49.0	179 03.8	8.1	15 10.8	11.5	59.7
N 10	327 48.7	48.0	193 30.9	8.1	14 59.3	11.7	59.8
E 11	342 48.9	47.1	207 58.0	8.2	14 47.6	11.7	59.8
S 12	357 49.1	S 1 46.1	222 25.2	8.2	N14 35.9	11.8	59.8
D 13	12 49.2	45.1	236 52.4	8.2	14 24.1	11.9	59.9
A 14	27 49.4	44.1	251 19.6	8.2	14 12.2	12.1	59.9
Y 15	42 49.6	. . 43.1	265 46.8	8.2	14 00.1	12.1	59.9
16	57 49.8	42.1	280 14.0	8.2	13 48.0	12.2	60.0
17	72 50.0	41.1	294 41.2	8.3	13 35.8	12.4	60.0
18	87 50.1	S 1 40.1	309 08.5	8.2	N13 23.4	12.4	60.0
19	102 50.3	39.2	323 35.7	8.3	13 11.0	12.5	60.1
20	117 50.5	38.2	338 03.0	8.3	12 58.5	12.6	60.1
21	132 50.7	. . 37.2	352 30.3	8.4	12 45.9	12.7	60.2
22	147 50.9	36.2	6 57.7	8.3	12 33.2	12.8	60.2
23	162 51.0	35.2	21 25.0	8.3	N12 20.4	12.9	60.2
	SD 16.1	d 1.0	SD 15.8		16.0		16.3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 14	Moonrise 15	Moonrise 16	Moonrise 17
°	h m	h m	h m	h m	h m	h m	h m
N 72	03 56	05 19	06 26	▭	▭	11 38	14 14
N 70	04 10	05 24	06 24	▭	09 27	12 11	14 29
68	04 20	05 27	06 23	▭	10 23	12 35	14 40
66	04 29	05 30	06 21	08 59	10 56	12 53	14 49
64	04 37	05 33	06 20	09 38	11 20	13 08	14 57
62	04 43	05 35	06 19	10 05	11 39	13 20	15 04
60	04 48	05 37	06 18	10 26	11 54	13 30	15 09
N 58	04 52	05 38	06 17	10 43	12 07	13 39	15 14
56	04 56	05 40	06 17	10 57	12 19	13 47	15 19
54	04 59	05 41	06 16	11 10	12 29	13 54	15 23
52	05 02	05 42	06 15	11 21	12 37	14 00	15 26
50	05 05	05 43	06 15	11 30	12 45	14 06	15 30
45	05 10	05 44	06 13	11 51	13 02	14 18	15 37
N 40	05 14	05 45	06 12	12 07	13 16	14 28	15 42
35	05 17	05 46	06 11	12 21	13 27	14 36	15 47
30	05 19	05 47	06 10	12 33	13 37	14 44	15 52
20	05 21	05 47	06 09	12 54	13 54	14 57	15 59
N 10	05 22	05 46	06 07	13 11	14 09	15 08	16 06
0	05 21	05 45	06 06	13 28	14 23	15 18	16 12
S 10	05 19	05 43	06 04	13 45	14 37	15 29	16 19
20	05 15	05 40	06 02	14 02	14 52	15 40	16 25
30	05 08	05 36	06 00	14 23	15 09	15 52	16 33
35	05 04	05 33	05 59	14 35	15 19	15 59	16 37
40	04 58	05 30	05 57	14 48	15 30	16 08	16 42
45	04 51	05 26	05 55	15 04	15 43	16 17	16 48
S 50	04 42	05 21	05 53	15 24	15 59	16 29	16 54
52	04 38	05 18	05 52	15 34	16 07	16 34	16 57
54	04 33	05 15	05 51	15 44	16 15	16 40	17 01
56	04 27	05 12	05 50	15 56	16 24	16 46	17 04
58	04 20	05 09	05 48	16 10	16 35	16 54	17 09
S 60	04 13	05 05	05 47	16 26	16 47	17 02	17 13

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 14	Moonset 15	Moonset 16	Moonset 17
°	h m	h m	h m	h m	h m	h m	h m
N 72	17 54	19 02	20 26	▭	▭	06 52	06 10
N 70	17 56	18 57	20 12	▭	07 05	06 17	05 54
68	17 57	18 53	20 00	▭	06 09	05 52	05 40
66	17 59	18 50	19 51	05 35	05 35	05 32	05 29
64	18 00	18 47	19 44	04 56	05 10	05 16	05 20
62	18 01	18 45	19 37	04 29	04 50	05 03	05 12
60	18 01	18 43	19 32	04 08	04 34	04 52	05 05
N 58	18 02	18 41	19 27	03 50	04 20	04 42	04 59
56	18 03	18 40	19 23	03 36	04 08	04 33	04 53
54	18 03	18 38	19 20	03 23	03 58	04 26	04 48
52	18 04	18 37	19 17	03 12	03 49	04 19	04 44
50	18 04	18 37	19 14	03 02	03 40	04 12	04 40
45	18 05	18 35	19 09	02 41	03 23	03 59	04 31
N 40	18 06	18 33	19 05	02 24	03 08	03 48	04 23
35	18 07	18 32	19 02	02 09	02 56	03 38	04 17
30	18 08	18 32	19 00	01 57	02 45	03 30	04 11
20	18 09	18 31	18 57	01 35	02 26	03 15	04 01
N 10	18 11	18 32	18 56	01 17	02 10	03 02	03 52
0	18 12	18 33	18 57	00 59	01 54	02 50	03 44
S 10	18 14	18 35	18 59	00 42	01 39	02 37	03 36
20	18 15	18 38	19 03	00 23	01 22	02 24	03 26
30	18 18	18 41	19 09	00 01	01 03	02 09	03 16
35	18 19	18 44	19 14	24 52	00 52	02 00	03 10
40	18 20	18 47	19 19	24 39	00 39	01 50	03 03
45	18 22	18 51	19 26	24 24	00 24	01 38	02 55
S 50	18 24	18 56	19 35	24 05	00 05	01 23	02 45
52	18 25	18 59	19 39	23 56	25 16	01 16	02 41
54	18 26	19 01	19 44	23 46	25 08	01 08	02 36
56	18 27	19 04	19 49	23 34	25 00	01 00	02 30
58	18 28	19 08	19 56	23 21	24 50	00 50	02 24
S 60	18 30	19 12	20 03	23 05	24 39	00 39	02 16

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
14	09 26	09 18	12 09	19 41	07 14	10	66
15	09 09	09 01	12 09	20 36	08 09	11	76
16	08 53	08 44	12 09	21 31	09 04	12	85

UT	ARIES	VENUS −4.0		MARS +1.1		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
17 00	174 13.6	214 04.1	S15 37.6	185 30.1	S 5 56.5	163 13.9	N 3 32.5	339 08.7	S 3 29.9
01	189 16.1	229 03.6	36.8	200 30.7	55.7	178 15.8	32.8	354 11.3	29.8
02	204 18.5	244 03.0	36.0	215 31.4	54.9	193 17.7	33.0	9 13.9	29.8
03	219 21.0	259 02.5	. . 35.3	230 32.0	. . 54.2	208 19.6	. . 33.2	24 16.6	. . 29.7
04	234 23.5	274 02.0	34.5	245 32.7	53.4	223 21.5	33.5	39 19.2	29.6
05	249 25.9	289 01.4	33.7	260 33.3	52.6	238 23.5	33.7	54 21.8	29.5
06	264 28.4	304 00.9	S15 32.9	275 34.0	S 5 51.8	253 25.4	N 3 33.9	69 24.4	S 3 29.5
07	279 30.9	319 00.4	32.2	290 34.6	51.1	268 27.3	34.2	84 27.1	29.4
T 08	294 33.3	333 59.8	31.4	305 35.3	50.3	283 29.2	34.4	99 29.7	29.3
H 09	309 35.8	348 59.3	. . 30.6	320 35.9	. . 49.5	298 31.1	. . 34.6	114 32.3	. . 29.2
U 10	324 38.3	3 58.8	29.8	335 36.6	48.7	313 33.0	34.9	129 34.9	29.2
R 11	339 40.7	18 58.3	29.0	350 37.2	48.0	328 35.0	35.1	144 37.6	29.1
S 12	354 43.2	33 57.7	S15 28.3	5 37.9	S 5 47.2	343 36.9	N 3 35.3	159 40.2	S 3 29.0
D 13	9 45.7	48 57.2	27.5	20 38.5	46.4	358 38.8	35.6	174 42.8	28.9
A 14	24 48.1	63 56.7	26.7	35 39.2	45.6	13 40.7	35.8	189 45.5	28.9
Y 15	39 50.6	78 56.1	. . 25.9	50 39.9	. . 44.9	28 42.6	. . 36.1	204 48.1	. . 28.8
16	54 53.0	93 55.6	25.1	65 40.5	44.1	43 44.5	36.3	219 50.7	28.7
17	69 55.5	108 55.1	24.3	80 41.2	43.3	58 46.5	36.5	234 53.3	28.7
18	84 58.0	123 54.6	S15 23.6	95 41.8	S 5 42.5	73 48.4	N 3 36.8	249 56.0	S 3 28.6
19	100 00.4	138 54.0	22.8	110 42.5	41.7	88 50.3	37.0	264 58.6	28.5
20	115 02.9	153 53.5	22.0	125 43.1	41.0	103 52.2	37.2	280 01.2	28.4
21	130 05.4	168 53.0	. . 21.2	140 43.8	. . 40.2	118 54.1	. . 37.5	295 03.8	. . 28.4
22	145 07.8	183 52.5	20.4	155 44.4	39.4	133 56.0	37.7	310 06.5	28.3
23	160 10.3	198 51.9	19.6	170 45.1	38.6	148 57.9	37.9	325 09.1	28.2
18 00	175 12.8	213 51.4	S15 18.8	185 45.7	S 5 37.9	163 59.9	N 3 38.2	340 11.7	S 3 28.1
01	190 15.2	228 50.9	18.0	200 46.4	37.1	179 01.8	38.4	355 14.4	28.1
02	205 17.7	243 50.4	17.2	215 47.0	36.3	194 03.7	38.6	10 17.0	28.0
03	220 20.1	258 49.8	. . 16.4	230 47.7	. . 35.5	209 05.6	. . 38.9	25 19.6	. . 27.9
04	235 22.6	273 49.3	15.6	245 48.3	34.7	224 07.5	39.1	40 22.2	27.8
05	250 25.1	288 48.8	14.9	260 49.0	34.0	239 09.4	39.3	55 24.9	27.8
06	265 27.5	303 48.3	S15 14.1	275 49.6	S 5 33.2	254 11.4	N 3 39.6	70 27.5	S 3 27.7
07	280 30.0	318 47.7	13.3	290 50.3	32.4	269 13.3	39.8	85 30.1	27.6
08	295 32.5	333 47.2	12.5	305 50.9	31.6	284 15.2	40.0	100 32.8	27.6
F 09	310 34.9	348 46.7	. . 11.7	320 51.6	. . 30.9	299 17.1	. . 40.3	115 35.4	. . 27.5
R 10	325 37.4	3 46.2	10.9	335 52.2	30.1	314 19.0	40.5	130 38.0	27.4
I 11	340 39.9	18 45.6	10.1	350 52.9	29.3	329 20.9	40.7	145 40.6	27.3
D 12	355 42.3	33 45.1	S15 09.3	5 53.5	S 5 28.5	344 22.8	N 3 41.0	160 43.3	S 3 27.3
A 13	10 44.8	48 44.6	08.5	20 54.2	27.7	359 24.8	41.2	175 45.9	27.2
Y 14	25 47.3	63 44.1	07.7	35 54.9	27.0	14 26.7	41.4	190 48.5	27.1
15	40 49.7	78 43.6	. . 06.9	50 55.5	. . 26.2	29 28.6	. . 41.7	205 51.2	. . 27.0
16	55 52.2	93 43.0	06.1	65 56.2	25.4	44 30.5	41.9	220 53.8	27.0
17	70 54.6	108 42.5	05.3	80 56.8	24.6	59 32.4	42.2	235 56.4	26.9
18	85 57.1	123 42.0	S15 04.5	95 57.5	S 5 23.8	74 34.3	N 3 42.4	250 59.0	S 3 26.8
19	100 59.6	138 41.5	03.7	110 58.1	23.1	89 36.2	42.6	266 01.7	26.7
20	116 02.0	153 41.0	02.8	125 58.8	22.3	104 38.2	42.9	281 04.3	26.7
21	131 04.5	168 40.4	. . 02.0	140 59.4	. . 21.5	119 40.1	. . 43.1	296 06.9	. . 26.6
22	146 07.0	183 39.9	01.2	156 00.1	20.7	134 42.0	43.3	311 09.6	26.5
23	161 09.4	198 39.4	15 00.4	171 00.7	20.0	149 43.9	43.6	326 12.2	26.4
19 00	176 11.9	213 38.9	S14 59.6	186 01.4	S 5 19.2	164 45.8	N 3 43.8	341 14.8	S 3 26.4
01	191 14.4	228 38.4	58.8	201 02.1	18.4	179 47.7	44.0	356 17.4	26.3
02	206 16.8	243 37.9	58.0	216 02.7	17.6	194 49.6	44.3	11 20.1	26.2
03	221 19.3	258 37.3	. . 57.2	231 03.4	. . 16.8	209 51.6	. . 44.5	26 22.7	. . 26.2
04	236 21.7	273 36.8	56.4	246 04.0	16.1	224 53.5	44.7	41 25.3	26.1
05	251 24.2	288 36.3	55.6	261 04.7	15.3	239 55.4	45.0	56 28.0	26.0
06	266 26.7	303 35.8	S14 54.7	276 05.3	S 5 14.5	254 57.3	N 3 45.2	71 30.6	S 3 25.9
07	281 29.1	318 35.3	53.9	291 06.0	13.7	269 59.2	45.4	86 33.2	25.9
S 08	296 31.6	333 34.8	53.1	306 06.6	12.9	285 01.1	45.7	101 35.9	25.8
A 09	311 34.1	348 34.3	. . 52.3	321 07.3	. . 12.2	300 03.0	. . 45.9	116 38.5	. . 25.7
T 10	326 36.5	3 33.7	51.5	336 07.9	11.4	315 05.0	46.1	131 41.1	25.6
U 11	341 39.0	18 33.2	50.7	351 08.6	10.6	330 06.9	46.4	146 43.7	25.6
R 12	356 41.5	33 32.7	S14 49.9	6 09.3	S 5 09.8	345 08.8	N 3 46.6	161 46.4	S 3 25.5
D 13	11 43.9	48 32.2	49.0	21 09.9	09.0	0 10.7	46.8	176 49.0	25.4
A 14	26 46.4	63 31.7	48.2	36 10.6	08.3	15 12.6	47.1	191 51.6	25.3
Y 15	41 48.9	78 31.2	. . 47.4	51 11.2	. . 07.5	30 14.5	. . 47.3	206 54.3	. . 25.3
16	56 51.3	93 30.7	46.6	66 11.9	06.7	45 16.4	47.5	221 56.9	25.2
17	71 53.8	108 30.2	45.8	81 12.5	05.9	60 18.4	47.8	236 59.5	25.1
18	86 56.2	123 29.6	S14 44.9	96 13.2	S 5 05.1	75 20.3	N 3 48.0	252 02.2	S 3 25.0
19	101 58.7	138 29.1	44.1	111 13.9	04.4	90 22.2	48.3	267 04.8	25.0
20	117 01.2	153 28.6	43.3	126 14.5	03.6	105 24.1	48.5	282 07.4	24.9
21	132 03.6	168 28.1	. . 42.5	141 15.2	. . 02.8	120 26.0	. . 48.7	297 10.1	. . 24.8
22	147 06.1	183 27.6	41.6	156 15.8	02.0	135 27.9	49.0	312 12.7	24.7
23	162 08.6	198 27.1	40.8	171 16.5	01.2	150 29.8	49.2	327 15.3	24.7
Mer. Pass.	h m 12 17.1	v −0.5	d 0.8	v 0.7	d 0.8	v 1.9	d 0.2	v 2.6	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.8
Achernar	335 28.4	S57 10.9
Acrux	173 10.5	S63 09.8
Adhara	255 13.7	S28 59.6
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.4	N55 53.7
Alkaid	152 59.6	N49 15.1
Al Na'ir	27 46.1	S46 54.3
Alnilam	275 48.0	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.1	N26 40.3
Alpheratz	357 45.6	N29 09.2
Altair	62 10.0	N 8 53.8
Ankaa	353 17.6	S42 14.7
Antares	112 28.1	S26 27.4
Arcturus	145 56.9	N19 07.2
Atria	107 31.3	S69 02.6
Avior	234 18.4	S59 33.1
Bellatrix	278 33.8	N 6 21.5
Betelgeuse	271 03.0	N 7 24.4
Canopus	263 56.8	S52 42.5
Capella	280 36.9	N46 00.7
Deneb	49 32.9	N45 19.1
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.6
Dubhe	193 52.8	N61 41.3
Elnath	278 14.7	N28 37.0
Eltanin	90 46.9	N51 28.9
Enif	33 49.0	N 9 55.5
Fomalhaut	15 26.0	S29 33.7
Gacrux	172 02.2	S57 10.7
Gienah	175 53.6	S17 36.5
Hadar	148 49.8	S60 25.6
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 46.0	S34 22.6
Kochab	137 18.9	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.5	S69 46.1
Mirfak	308 43.0	N49 54.2
Nunki	76 00.4	S26 16.9
Peacock	53 22.0	S56 41.7
Pollux	243 29.5	N27 59.9
Procyon	245 01.3	N 5 11.6
Rasalhague	96 07.9	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.6	S 8 11.5
Rigil Kent.	139 53.5	S60 52.8
Sabik	102 14.3	S15 44.4
Schedar	349 43.0	N56 36.0
Shaula	96 24.1	S37 06.6
Sirius	258 35.1	S16 44.2
Spica	158 32.7	S11 13.4
Suhail	222 53.3	S43 29.0
Vega	80 40.1	N38 47.4
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	38 38.6	9 45
Mars	10 33.0	11 36
Jupiter	348 47.1	13 02
Saturn	164 59.0	1 19

UT	SUN			MOON					
	GHA		Dec	GHA	v		Dec	d	HP
d h	° ′		° ′	° ′	′		° ′	′	′
17 00	177 51.2	S	1 34.2	35 52.3	8.4	N	12 07.5	13.0	60.3
01	192 51.4		33.2	50 19.7	8.4		11 54.5	13.0	60.3
02	207 51.6		32.2	64 47.1	8.4		11 41.5	13.2	60.3
03	222 51.7	. .	31.3	79 14.5	8.4		11 28.3	13.2	60.4
04	237 51.9		30.3	93 41.9	8.4		11 15.1	13.3	60.4
05	252 52.1		29.3	108 09.3	8.5		11 01.8	13.4	60.4
06	267 52.3	S	1 28.3	122 36.8	8.4	N	10 48.4	13.5	60.4
07	282 52.5		27.3	137 04.2	8.5		10 34.9	13.5	60.5
T 08	297 52.6		26.3	151 31.7	8.4		10 21.4	13.7	60.5
H 09	312 52.8	. .	25.3	165 59.1	8.5		10 07.7	13.7	60.5
U 10	327 53.0		24.3	180 26.6	8.5		9 54.0	13.8	60.6
R 11	342 53.2		23.3	194 54.1	8.5		9 40.2	13.8	60.6
S 12	357 53.4	S	1 22.4	209 21.6	8.6	N	9 26.4	14.0	60.6
D 13	12 53.5		21.4	223 49.2	8.5		9 12.4	13.9	60.7
A 14	27 53.7		20.4	238 16.7	8.5		8 58.5	14.1	60.7
Y 15	42 53.9	. .	19.4	252 44.2	8.6		8 44.4	14.1	60.7
16	57 54.1		18.4	267 11.8	8.5		8 30.3	14.2	60.7
17	72 54.3		17.4	281 39.3	8.6		8 16.1	14.3	60.8
18	87 54.4	S	1 16.4	296 06.9	8.6	N	8 01.8	14.3	60.8
19	102 54.6		15.4	310 34.5	8.6		7 47.5	14.4	60.8
20	117 54.8		14.5	325 02.1	8.5		7 33.1	14.5	60.9
21	132 55.0	. .	13.5	339 29.6	8.6		7 18.6	14.5	60.9
22	147 55.2		12.5	353 57.2	8.6		7 04.1	14.5	60.9
23	162 55.4		11.5	8 24.8	8.6		6 49.6	14.6	60.9
18 00	177 55.5	S	1 10.5	22 52.4	8.7	N	6 35.0	14.7	61.0
01	192 55.7		09.5	37 20.1	8.6		6 20.3	14.7	61.0
02	207 55.9		08.5	51 47.7	8.6		6 05.6	14.8	61.0
03	222 56.1	. .	07.5	66 15.3	8.6		5 50.8	14.8	61.0
04	237 56.3		06.5	80 42.9	8.6		5 36.0	14.8	61.0
05	252 56.4		05.6	95 10.5	8.7		5 21.2	14.9	61.1
06	267 56.6	S	1 04.6	109 38.2	8.6	N	5 06.3	15.0	61.1
07	282 56.8		03.6	124 05.8	8.6		4 51.3	14.9	61.1
08	297 57.0		02.6	138 33.4	8.6		4 36.4	15.1	61.1
F 09	312 57.2	. .	01.6	153 01.0	8.7		4 21.3	15.0	61.1
R 10	327 57.3		1 00.6	167 28.7	8.6		4 06.3	15.1	61.2
I 11	342 57.5		0 59.6	181 56.3	8.6		3 51.2	15.1	61.2
D 12	357 57.7	S	0 58.6	196 23.9	8.6	N	3 36.1	15.2	61.2
A 13	12 57.9		57.7	210 51.5	8.6		3 20.9	15.2	61.2
Y 14	27 58.1		56.7	225 19.1	8.6		3 05.7	15.2	61.2
15	42 58.3	. .	55.7	239 46.7	8.7		2 50.5	15.2	61.3
16	57 58.4		54.7	254 14.4	8.6		2 35.3	15.3	61.3
17	72 58.6		53.7	268 42.0	8.5		2 20.0	15.3	61.3
18	87 58.8	S	0 52.7	283 09.5	8.6	N	2 04.7	15.3	61.3
19	102 59.0		51.7	297 37.1	8.6		1 49.4	15.3	61.3
20	117 59.2		50.7	312 04.7	8.6		1 34.1	15.3	61.3
21	132 59.4	. .	49.8	326 32.3	8.5		1 18.8	15.4	61.3
22	147 59.5		48.8	340 59.8	8.6		1 03.4	15.3	61.4
23	162 59.7		47.8	355 27.4	8.5		0 48.1	15.4	61.4
19 00	177 59.9	S	0 46.8	9 54.9	8.6	N	0 32.7	15.4	61.4
01	193 00.1		45.8	24 22.5	8.5		0 17.3	15.4	61.4
02	208 00.3		44.8	38 50.0	8.5	N	0 01.9	15.4	61.4
03	223 00.5	. .	43.8	53 17.5	8.5	S	0 13.5	15.4	61.4
04	238 00.6		42.8	67 45.0	8.5		0 28.9	15.4	61.4
05	253 00.8		41.8	82 12.5	8.4		0 44.3	15.4	61.4
06	268 01.0	S	0 40.9	96 39.9	8.5	S	0 59.7	15.4	61.4
07	283 01.2		39.9	111 07.4	8.4		1 15.1	15.4	61.5
S 08	298 01.4		38.9	125 34.8	8.4		1 30.5	15.4	61.5
A 09	313 01.6	. .	37.9	140 02.2	8.4		1 45.9	15.4	61.5
T 10	328 01.7		36.9	154 29.6	8.4		2 01.3	15.3	61.5
U 11	343 01.9		35.9	168 57.0	8.4		2 16.6	15.4	61.5
R 12	358 02.1	S	0 34.9	183 24.4	8.3	S	2 32.0	15.4	61.5
D 13	13 02.3		33.9	197 51.7	8.3		2 47.4	15.3	61.5
A 14	28 02.5		33.0	212 19.0	8.3		3 02.7	15.3	61.5
Y 15	43 02.7	. .	32.0	226 46.3	8.3		3 18.0	15.3	61.5
16	58 02.8		31.0	241 13.6	8.3		3 33.3	15.3	61.5
17	73 03.0		30.0	255 40.9	8.2		3 48.6	15.2	61.5
18	88 03.2	S	0 29.0	270 08.1	8.2	S	4 03.8	15.2	61.5
19	103 03.4		28.0	284 35.3	8.2		4 19.0	15.2	61.5
20	118 03.6		27.0	299 02.5	8.2		4 34.2	15.2	61.5
21	133 03.8	. .	26.0	313 29.7	8.1		4 49.4	15.1	61.5
22	148 03.9		25.0	327 56.8	8.1		5 04.5	15.1	61.5
23	163 04.1		24.1	342 23.9	8.1	S	5 19.6	15.1	61.5
	SD 16.1		d 1.0	SD	16.5		16.7		16.8

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		17	18	19	20
	h m	h m	h m	h m	h m	h m	h m
N 72	03 37	05 03	06 11	14 14	16 37	18 58	21 26
N 70	03 53	05 10	06 10	14 29	16 40	18 51	21 07
68	04 06	05 15	06 10	14 40	16 43	18 45	20 52
66	04 17	05 19	06 10	14 49	16 45	18 41	20 40
64	04 25	05 22	06 09	14 57	16 47	18 37	20 29
62	04 32	05 25	06 09	15 04	16 48	18 34	20 21
60	04 38	05 28	06 09	15 09	16 50	18 31	20 14
N 58	04 43	05 30	06 09	15 14	16 51	18 29	20 07
56	04 48	05 32	06 09	15 19	16 52	18 27	20 02
54	04 52	05 33	06 08	15 23	16 53	18 25	19 57
52	04 55	05 35	06 08	15 26	16 54	18 23	19 52
50	04 58	05 36	06 08	15 30	16 55	18 21	19 48
45	05 04	05 39	06 08	15 37	16 57	18 18	19 39
N 40	05 09	05 41	06 07	15 42	16 58	18 15	19 32
35	05 13	05 42	06 07	15 47	16 59	18 12	19 26
30	05 15	05 43	06 07	15 52	17 01	18 10	19 20
20	05 19	05 44	06 06	15 59	17 03	18 06	19 11
N 10	05 20	05 45	06 06	16 06	17 04	18 03	19 03
0	05 20	05 44	06 05	16 12	17 06	18 00	18 55
S 10	05 19	05 43	06 04	16 19	17 08	17 57	18 48
20	05 15	05 41	06 03	16 25	17 10	17 54	18 40
30	05 10	05 38	06 02	16 33	17 12	17 51	18 31
35	05 06	05 36	06 01	16 37	17 13	17 49	18 26
40	05 01	05 33	06 00	16 42	17 14	17 46	18 20
45	04 55	05 30	05 59	16 48	17 16	17 44	18 13
S 50	04 47	05 26	05 58	16 54	17 18	17 41	18 05
52	04 43	05 23	05 57	16 57	17 19	17 39	18 02
54	04 39	05 21	05 57	17 01	17 20	17 38	17 58
56	04 34	05 19	05 56	17 04	17 21	17 36	17 53
58	04 28	05 16	05 55	17 09	17 22	17 35	17 48
S 60	04 21	05 12	05 54	17 13	17 23	17 32	17 43

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	17	18	19	20
°	h m	h m	h m	h m	h m	h m	h m
N 72	18 08	19 16	20 44	06 10	05 43	05 19	04 55
N 70	18 08	19 09	20 26	05 54	05 36	05 21	05 04
68	18 08	19 04	20 13	05 40	05 31	05 22	05 13
66	18 08	19 00	20 02	05 29	05 26	05 23	05 19
64	18 09	18 56	19 54	05 20	05 22	05 23	05 25
62	18 09	18 53	19 46	05 12	05 18	05 24	05 30
60	18 09	18 50	19 40	05 05	05 15	05 25	05 34
N 58	18 09	18 48	19 35	04 59	05 13	05 25	05 38
56	18 09	18 46	19 30	04 53	05 10	05 26	05 42
54	18 09	18 44	19 26	04 48	05 08	05 26	05 45
52	18 09	18 43	19 22	04 44	05 06	05 27	05 48
50	18 09	18 41	19 19	04 40	05 04	05 27	05 50
45	18 09	18 39	19 13	04 31	05 00	05 28	05 56
N 40	18 09	18 37	19 08	04 23	04 56	05 28	06 01
35	18 10	18 35	19 04	04 17	04 53	05 29	06 05
30	18 10	18 34	19 02	04 11	04 51	05 29	06 09
20	18 10	18 32	18 58	04 01	04 46	05 30	06 15
N 10	18 11	18 32	18 56	03 52	04 42	05 31	06 21
0	18 11	18 32	18 56	03 44	04 38	05 32	06 26
S 10	18 12	18 33	18 57	03 36	04 34	05 32	06 31
20	18 13	18 35	19 00	03 26	04 29	05 33	06 37
30	18 14	18 38	19 06	03 16	04 24	05 34	06 43
35	18 15	18 40	19 09	03 10	04 22	05 34	06 47
40	18 15	18 42	19 14	03 03	04 18	05 34	06 51
45	18 16	18 46	19 20	02 55	04 14	05 35	06 56
S 50	18 17	18 50	19 28	02 45	04 10	05 36	07 02
52	18 18	18 52	19 32	02 41	04 08	05 36	07 05
54	18 19	18 54	19 36	02 36	04 05	05 36	07 08
56	18 19	18 56	19 41	02 30	04 03	05 37	07 11
58	18 20	18 59	19 46	02 24	04 00	05 37	07 15
S 60	18 21	19 02	19 53	02 16	03 56	05 37	07 19

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
17	08 36	08 27	12 08	22 25	09 58	13	92
18	08 18	08 10	12 08	23 19	10 52	14	97
19	08 01	07 52	12 08	24 13	11 46	15	100

UT	ARIES	VENUS −4.0		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
20 00	177 11.0	213 26.6	S14 40.0	186 17.1	S 5 00.5	165 31.7	N 3 49.4	342 17.9	S 3 24.6
01	192 13.5	228 26.1	39.2	201 17.8	4 59.7	180 33.7	49.7	357 20.6	24.5
02	207 16.0	243 25.6	38.3	216 18.5	58.9	195 35.6	49.9	12 23.2	24.4
03	222 18.4	258 25.1	. . 37.5	231 19.1	. . 58.1	210 37.5	. . 50.1	27 25.8	. . 24.4
04	237 20.9	273 24.5	36.7	246 19.8	57.3	225 39.4	50.4	42 28.5	24.3
05	252 23.4	288 24.0	35.8	261 20.4	56.6	240 41.3	50.6	57 31.1	24.2
06	267 25.8	303 23.5	S14 35.0	276 21.1	S 4 55.8	255 43.2	N 3 50.8	72 33.7	S 3 24.1
07	282 28.3	318 23.0	34.2	291 21.7	55.0	270 45.1	51.1	87 36.4	24.1
08	297 30.7	333 22.5	33.4	306 22.4	54.2	285 47.1	51.3	102 39.0	24.0
S 09	312 33.2	348 22.0	. . 32.5	321 23.1	. . 53.4	300 49.0	. . 51.5	117 41.6	. . 23.9
U 10	327 35.7	3 21.5	31.7	336 23.7	52.6	315 50.9	51.8	132 44.3	23.8
N 11	342 38.1	18 21.0	30.8	351 24.4	51.9	330 52.8	52.0	147 46.9	23.8
D 12	357 40.6	33 20.5	S14 30.0	6 25.0	S 4 51.1	345 54.7	N 3 52.2	162 49.5	S 3 23.7
A 13	12 43.1	48 20.0	29.2	21 25.7	50.3	0 56.6	52.5	177 52.2	23.6
Y 14	27 45.5	63 19.5	28.3	36 26.3	49.5	15 58.5	52.7	192 54.8	23.6
15	42 48.0	78 19.0	. . 27.5	51 27.0	. . 48.7	31 00.4	. . 52.9	207 57.4	. . 23.5
16	57 50.5	93 18.5	26.7	66 27.7	48.0	46 02.4	53.2	223 00.0	23.4
17	72 52.9	108 18.0	25.8	81 28.3	47.2	61 04.3	53.4	238 02.7	23.3
18	87 55.4	123 17.5	S14 25.0	96 29.0	S 4 46.4	76 06.2	N 3 53.7	253 05.3	S 3 23.3
19	102 57.8	138 17.0	24.1	111 29.6	45.6	91 08.1	53.9	268 07.9	23.2
20	118 00.3	153 16.5	23.3	126 30.3	44.8	106 10.0	54.1	283 10.6	23.1
21	133 02.8	168 16.0	. . 22.5	141 31.0	. . 44.0	121 11.9	. . 54.4	298 13.2	. . 23.0
22	148 05.2	183 15.5	21.6	156 31.6	43.3	136 13.8	54.6	313 15.8	23.0
23	163 07.7	198 15.0	20.8	171 32.3	42.5	151 15.7	54.8	328 18.5	22.9
21 00	178 10.2	213 14.5	S14 19.9	186 32.9	S 4 41.7	166 17.7	N 3 55.1	343 21.1	S 3 22.8
01	193 12.6	228 14.0	19.1	201 33.6	40.9	181 19.6	55.3	358 23.7	22.7
02	208 15.1	243 13.4	18.3	216 34.3	40.1	196 21.5	55.5	13 26.4	22.7
03	223 17.6	258 12.9	. . 17.4	231 34.9	. . 39.4	211 23.4	. . 55.8	28 29.0	. . 22.6
04	238 20.0	273 12.4	16.6	246 35.6	38.6	226 25.3	56.0	43 31.6	22.5
05	253 22.5	288 11.9	15.7	261 36.2	37.8	241 27.2	56.2	58 34.3	22.4
06	268 25.0	303 11.4	S14 14.9	276 36.9	S 4 37.0	256 29.1	N 3 56.5	73 36.9	S 3 22.4
07	283 27.4	318 11.0	14.0	291 37.6	36.2	271 31.0	56.7	88 39.5	22.3
08	298 29.9	333 10.5	13.2	306 38.2	35.4	286 33.0	56.9	103 42.2	22.2
M 09	313 32.3	348 10.0	. . 12.3	321 38.9	. . 34.7	301 34.9	. . 57.2	118 44.8	. . 22.1
O 10	328 34.8	3 09.5	11.5	336 39.5	33.9	316 36.8	57.4	133 47.4	22.1
N 11	343 37.3	18 09.0	10.6	351 40.2	33.1	331 38.7	57.6	148 50.1	22.0
D 12	358 39.7	33 08.5	S14 09.8	6 40.9	S 4 32.3	346 40.6	N 3 57.9	163 52.7	S 3 21.9
A 13	13 42.2	48 08.0	08.9	21 41.5	31.5	1 42.5	58.1	178 55.3	21.8
Y 14	28 44.7	63 07.5	08.1	36 42.2	30.7	16 44.4	58.3	193 58.0	21.8
15	43 47.1	78 07.0	. . 07.2	51 42.8	. . 30.0	31 46.3	. . 58.6	209 00.6	. . 21.7
16	58 49.6	93 06.5	06.3	66 43.5	29.2	46 48.3	58.8	224 03.2	21.6
17	73 52.1	108 06.0	05.5	81 44.2	28.4	61 50.2	59.1	239 05.9	21.5
18	88 54.5	123 05.5	S14 04.6	96 44.8	S 4 27.6	76 52.1	N 3 59.3	254 08.5	S 3 21.5
19	103 57.0	138 05.0	03.8	111 45.5	26.8	91 54.0	59.5	269 11.1	21.4
20	118 59.4	153 04.5	02.9	126 46.1	26.0	106 55.9	3 59.8	284 13.8	21.3
21	134 01.9	168 04.0	. . 02.1	141 46.8	. . 25.3	121 57.8	4 00.0	299 16.4	. . 21.2
22	149 04.4	183 03.5	01.2	156 47.5	24.5	136 59.7	00.2	314 19.0	21.2
23	164 06.8	198 03.0	14 00.3	171 48.1	23.7	152 01.6	00.5	329 21.7	21.1
22 00	179 09.3	213 02.5	S13 59.5	186 48.8	S 4 22.9	167 03.5	N 4 00.7	344 24.3	S 3 21.0
01	194 11.8	228 02.0	58.6	201 49.5	22.1	182 05.5	00.9	359 26.9	20.9
02	209 14.2	243 01.5	57.8	216 50.1	21.3	197 07.4	01.2	14 29.6	20.9
03	224 16.7	258 01.0	. . 56.9	231 50.8	. . 20.6	212 09.3	. . 01.4	29 32.2	. . 20.8
04	239 19.2	273 00.5	56.0	246 51.4	19.8	227 11.2	01.6	44 34.8	20.7
05	254 21.6	288 00.0	55.2	261 52.1	19.0	242 13.1	01.9	59 37.5	20.6
06	269 24.1	302 59.6	S13 54.3	276 52.8	S 4 18.2	257 15.0	N 4 02.1	74 40.1	S 3 20.6
07	284 26.6	317 59.1	53.4	291 53.4	17.4	272 16.9	02.3	89 42.7	20.5
T 08	299 29.0	332 58.6	52.6	306 54.1	16.6	287 18.8	02.6	104 45.4	20.4
U 09	314 31.5	347 58.1	. . 51.7	321 54.8	. . 15.9	302 20.7	. . 02.8	119 48.0	. . 20.3
E 10	329 33.9	2 57.6	50.8	336 55.4	15.1	317 22.7	03.0	134 50.6	20.3
S 11	344 36.4	17 57.1	50.0	351 56.1	14.3	332 24.6	03.3	149 53.3	20.2
D 12	359 38.9	32 56.6	S13 49.1	6 56.7	S 4 13.5	347 26.5	N 4 03.5	164 55.9	S 3 20.1
A 13	14 41.3	47 56.1	48.2	21 57.4	12.7	2 28.4	03.7	179 58.5	20.0
Y 14	29 43.8	62 55.6	47.4	36 58.1	11.9	17 30.3	04.0	195 01.2	20.0
15	44 46.3	77 55.1	. . 46.5	51 58.7	. . 11.2	32 32.2	. . 04.2	210 03.8	. . 19.9
16	59 48.7	92 54.7	45.6	66 59.4	10.4	47 34.1	04.5	225 06.4	19.8
17	74 51.2	107 54.2	44.8	82 00.1	09.6	62 36.0	04.7	240 09.1	19.7
18	89 53.7	122 53.7	S13 43.9	97 00.7	S 4 08.8	77 37.9	N 4 04.9	255 11.7	S 3 19.7
19	104 56.1	137 53.2	43.0	112 01.4	08.0	92 39.9	05.2	270 14.4	19.6
20	119 58.6	152 52.7	42.1	127 02.0	07.2	107 41.8	05.4	285 17.0	19.5
21	135 01.1	167 52.2	. . 41.3	142 02.7	. . 06.4	122 43.7	. . 05.6	300 19.6	. . 19.4
22	150 03.5	182 51.7	40.4	157 03.4	05.7	137 45.6	05.9	315 22.3	19.3
23	165 06.0	197 51.2	39.5	172 04.0	04.9	152 47.5	06.1	330 24.9	19.3
	h m								
Mer. Pass.	12 05.3	*v* −0.5	*d* 0.9	*v* 0.7	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.8
Achernar	335 28.4	S57 10.9
Acrux	173 10.5	S63 09.8
Adhara	255 13.7	S28 59.6
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.4	N55 53.7
Alkaid	152 59.6	N49 15.2
Al Na'ir	27 46.1	S46 54.3
Alnilam	275 48.0	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.1	N26 40.3
Alpheratz	357 45.6	N29 09.1
Altair	62 09.9	N 8 53.8
Ankaa	353 17.6	S42 14.7
Antares	112 28.1	S26 27.4
Arcturus	145 56.9	N19 07.2
Atria	107 31.3	S69 02.6
Avior	234 18.4	S59 33.1
Bellatrix	278 33.8	N 6 21.5
Betelgeuse	271 03.0	N 7 24.4
Canopus	263 56.8	S52 42.5
Capella	280 36.9	N46 00.7
Deneb	49 32.9	N45 19.1
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.5
Dubhe	193 52.9	N61 41.3
Elnath	278 14.7	N28 37.0
Eltanin	90 46.9	N51 28.9
Enif	33 49.0	N 9 55.5
Fomalhaut	15 26.0	S29 33.7
Gacrux	172 02.2	S57 10.7
Gienah	175 53.6	S17 36.5
Hadar	148 49.7	S60 25.6
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 46.0	S34 22.6
Kochab	137 18.9	N74 06.2
Markab	13 40.3	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.5	S69 46.1
Mirfak	308 43.0	N49 54.2
Nunki	76 00.4	S26 16.9
Peacock	53 22.0	S56 41.7
Pollux	243 29.5	N27 59.9
Procyon	245 01.3	N 5 11.6
Rasalhague	96 07.9	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.7	S 8 11.5
Rigil Kent.	139 53.5	S60 52.8
Sabik	102 14.3	S15 44.4
Schedar	349 43.0	N56 36.0
Shaula	96 24.0	S37 06.6
Sirius	258 35.1	S16 44.2
Spica	158 32.7	S11 13.4
Suhail	222 53.4	S43 29.0
Vega	80 40.1	N38 47.4
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	35 04.3	9 47
Mars	8 22.8	11 33
Jupiter	348 07.5	12 53
Saturn	165 10.9	1 06

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
20 00	178 04.3	S 0 23.1	356 51.0	8.1	S 5 34.7	15.0	61.5
01	193 04.5	22.1	11 18.1	8.0	5 49.7	15.0	61.5
02	208 04.7	21.1	25 45.1	8.0	6 04.7	15.0	61.5
03	223 04.9	. . 20.1	40 12.1	8.0	6 19.7	14.9	61.5
04	238 05.1	19.1	54 39.1	7.9	6 34.6	14.8	61.5
05	253 05.2	18.1	69 06.0	8.0	6 49.4	14.8	61.5
06	268 05.4	S 0 17.1	83 33.0	7.9	S 7 04.2	14.8	61.5
07	283 05.6	16.2	97 59.9	7.8	7 19.0	14.7	61.5
08	298 05.8	15.2	112 26.7	7.8	7 33.7	14.7	61.4
S 09	313 06.0	. . 14.2	126 53.5	7.8	7 48.4	14.6	61.4
U 10	328 06.2	13.2	141 20.3	7.8	8 03.0	14.5	61.4
N 11	343 06.4	12.2	155 47.1	7.7	8 17.5	14.5	61.4
D 12	358 06.5	S 0 11.2	170 13.8	7.7	S 8 32.0	14.4	61.4
A 13	13 06.7	10.2	184 40.5	7.7	8 46.4	14.4	61.4
Y 14	28 06.9	09.2	199 07.2	7.6	9 00.8	14.3	61.4
15	43 07.1	. . 08.3	213 33.8	7.6	9 15.1	14.3	61.4
16	58 07.3	07.3	228 00.4	7.6	9 29.4	14.1	61.4
17	73 07.5	06.3	242 27.0	7.5	9 43.5	14.1	61.4
18	88 07.6	S 0 05.3	256 53.5	7.5	S 9 57.6	14.1	61.3
19	103 07.8	04.3	271 20.0	7.5	10 11.7	13.9	61.3
20	118 08.0	03.3	285 46.5	7.4	10 25.6	13.9	61.3
21	133 08.2	. . 02.3	300 12.9	7.4	10 39.5	13.8	61.3
22	148 08.4	01.3	314 39.3	7.4	10 53.3	13.7	61.3
23	163 08.6	S 00.4	329 05.7	7.3	11 07.0	13.7	61.3
21 00	178 08.8	N 0 00.6	343 32.0	7.3	S11 20.7	13.6	61.2
01	193 08.9	01.6	357 58.3	7.2	11 34.3	13.4	61.2
02	208 09.1	02.6	12 24.5	7.2	11 47.7	13.4	61.2
03	223 09.3	. . 03.6	26 50.7	7.2	12 01.1	13.4	61.2
04	238 09.5	04.6	41 16.9	7.1	12 14.5	13.2	61.2
05	253 09.7	05.6	55 43.0	7.1	12 27.7	13.1	61.2
06	268 09.9	N 0 06.6	70 09.1	7.1	S12 40.8	13.1	61.1
07	283 10.1	07.6	84 35.2	7.0	12 53.9	12.9	61.1
08	298 10.3	08.5	99 01.2	7.0	13 06.8	12.9	61.1
M 09	313 10.4	. . 09.5	113 27.2	7.0	13 19.7	12.7	61.1
O 10	328 10.6	10.5	127 53.2	6.9	13 32.4	12.7	61.1
N 11	343 10.8	11.5	142 19.1	6.9	13 45.1	12.5	61.0
D 12	358 11.0	N 0 12.5	156 45.0	6.8	S13 57.6	12.5	61.0
A 13	13 11.2	13.5	171 10.8	6.8	14 10.1	12.3	61.0
Y 14	28 11.4	14.5	185 36.6	6.8	14 22.4	12.3	61.0
15	43 11.6	. . 15.4	200 02.4	6.7	14 34.7	12.1	60.9
16	58 11.7	16.4	214 28.1	6.7	14 46.8	12.0	60.9
17	73 11.9	17.4	228 53.8	6.7	14 58.8	12.0	60.9
18	88 12.1	N 0 18.4	243 19.5	6.6	S15 10.8	11.8	60.9
19	103 12.3	19.4	257 45.1	6.6	15 22.6	11.7	60.8
20	118 12.5	20.4	272 10.7	6.5	15 34.3	11.6	60.8
21	133 12.7	. . 21.4	286 36.2	6.5	15 45.9	11.4	60.8
22	148 12.9	22.4	301 01.7	6.5	15 57.3	11.4	60.8
23	163 13.1	23.3	315 27.2	6.5	16 08.7	11.2	60.7
22 00	178 13.2	N 0 24.3	329 52.7	6.4	S16 19.9	11.1	60.7
01	193 13.4	25.3	344 18.1	6.4	16 31.0	11.0	60.7
02	208 13.6	26.3	358 43.5	6.3	16 42.0	10.9	60.6
03	223 13.8	. . 27.3	13 08.8	6.3	16 52.9	10.8	60.6
04	238 14.0	28.3	27 34.1	6.3	17 03.7	10.6	60.6
05	253 14.2	29.3	41 59.4	6.3	17 14.3	10.5	60.6
06	268 14.4	N 0 30.3	56 24.7	6.2	S17 24.8	10.4	60.5
07	283 14.6	31.2	70 49.9	6.2	17 35.2	10.2	60.5
T 08	298 14.7	32.2	85 15.1	6.1	17 45.4	10.1	60.5
U 09	313 14.9	. . 33.2	99 40.2	6.2	17 55.5	10.0	60.4
E 10	328 15.1	34.2	114 05.4	6.1	18 05.5	9.9	60.4
S 11	343 15.3	35.2	128 30.5	6.1	18 15.4	9.7	60.4
D 12	358 15.5	N 0 36.2	142 55.6	6.0	S18 25.1	9.6	60.3
A 13	13 15.7	37.2	157 20.6	6.0	18 34.7	9.4	60.3
Y 14	28 15.9	38.1	171 45.6	6.0	18 44.1	9.4	60.3
15	43 16.1	. . 39.1	186 10.6	6.0	18 53.5	9.1	60.2
16	58 16.2	40.1	200 35.6	6.0	19 02.6	9.1	60.2
17	73 16.4	41.1	215 00.6	5.9	19 11.7	8.9	60.2
18	88 16.6	N 0 42.1	229 25.5	5.9	S19 20.6	8.8	60.1
19	103 16.8	43.1	243 50.4	5.9	19 29.4	8.6	60.1
20	118 17.0	44.1	258 15.3	5.8	19 38.0	8.5	60.1
21	133 17.2	. . 45.1	272 40.1	5.9	19 46.5	8.3	60.0
22	148 17.4	46.0	287 05.0	5.8	19 54.8	8.2	60.0
23	163 17.6	47.0	301 29.8	5.8	S20 03.0	8.1	60.0
	SD 16.1	d 1.0	SD 16.7		16.6		16.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 20	Moonrise 21	Moonrise 22	Moonrise 23
°	h m	h m	h m	h m	h m	h m	h m
N 72	03 17	04 47	05 55	21 26	24 27	00 27	▬
N 70	03 37	04 55	05 56	21 07	23 36	▬	▬
68	03 52	05 02	05 57	20 52	23 04	25 32	01 32
66	04 04	05 07	05 58	20 40	22 41	24 46	00 46
64	04 13	05 11	05 59	20 29	22 23	24 16	00 16
62	04 22	05 15	05 59	20 21	22 08	23 53	25 27
60	04 28	05 18	06 00	20 14	21 56	23 35	25 03
N 58	04 34	05 21	06 00	20 07	21 45	23 20	24 45
56	04 39	05 24	06 01	20 02	21 36	23 07	24 29
54	04 44	05 26	06 01	19 57	21 28	22 56	24 15
52	04 48	05 28	06 01	19 52	21 21	22 46	24 03
50	04 51	05 29	06 02	19 48	21 14	22 37	23 53
45	04 59	05 33	06 02	19 39	21 00	22 19	23 31
N 40	05 04	05 36	06 03	19 32	20 49	22 04	23 14
35	05 08	05 38	06 03	19 26	20 39	21 51	22 59
30	05 12	05 39	06 03	19 20	20 31	21 40	22 46
20	05 16	05 42	06 04	19 11	20 16	21 21	22 25
N 10	05 19	05 43	06 04	19 03	20 03	21 05	22 06
0	05 19	05 43	06 04	18 55	19 52	20 50	21 48
S 10	05 19	05 43	06 04	18 48	19 40	20 35	21 31
20	05 16	05 42	06 04	18 40	19 28	20 19	21 12
30	05 12	05 40	06 04	18 31	19 14	20 00	20 51
35	05 09	05 38	06 04	18 26	19 06	19 50	20 39
40	05 05	05 36	06 03	18 20	18 56	19 38	20 24
45	04 59	05 34	06 03	18 13	18 46	19 23	20 08
S 50	04 52	05 30	06 03	18 05	18 33	19 06	19 47
52	04 49	05 29	06 02	18 02	18 27	18 58	19 37
54	04 45	05 27	06 02	17 58	18 21	18 49	19 26
56	04 41	05 25	06 02	17 53	18 13	18 39	19 13
58	04 36	05 22	06 02	17 48	18 05	18 28	18 59
S 60	04 30	05 20	06 01	17 43	17 56	18 14	18 42

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 20	Moonset 21	Moonset 22	Moonset 23
°	h m	h m	h m	h m	h m	h m	h m
N 72	18 22	19 31	21 02	04 55	04 23	03 23	▬
N 70	18 20	19 22	20 42	05 04	04 45	04 15	▬
68	18 19	19 15	20 26	05 13	05 02	04 49	04 23
66	18 18	19 10	20 14	05 19	05 16	05 13	05 10
64	18 17	19 05	20 04	05 25	05 28	05 32	05 41
62	18 17	19 01	19 55	05 30	05 37	05 48	06 04
60	18 16	18 58	19 48	05 34	05 46	06 01	06 23
N 58	18 15	18 55	19 42	05 38	05 53	06 12	06 39
56	18 15	18 52	19 37	05 42	06 00	06 22	06 52
54	18 15	18 50	19 32	05 45	06 06	06 31	07 04
52	18 14	18 48	19 28	05 48	06 11	06 39	07 14
50	18 14	18 46	19 24	05 50	06 16	06 46	07 23
45	18 13	18 42	19 17	05 56	06 27	07 02	07 42
N 40	18 13	18 40	19 11	06 01	06 36	07 14	07 58
35	18 12	18 37	19 07	06 05	06 43	07 25	08 12
30	18 12	18 36	19 04	06 09	06 50	07 35	08 23
20	18 11	18 33	18 59	06 15	07 02	07 51	08 44
N 10	18 11	18 32	18 56	06 21	07 12	08 06	09 01
0	18 11	18 31	18 55	06 26	07 22	08 19	09 18
S 10	18 10	18 31	18 56	06 31	07 31	08 33	09 34
20	18 10	18 32	18 58	06 37	07 42	08 47	09 52
30	18 10	18 34	19 02	06 43	07 54	09 04	10 12
35	18 10	18 36	19 05	06 47	08 01	09 13	10 24
40	18 11	18 37	19 09	06 51	08 08	09 25	10 37
45	18 11	18 40	19 14	06 56	08 18	09 38	10 54
S 50	18 11	18 43	19 21	07 02	08 29	09 54	11 14
52	18 11	18 45	19 24	07 05	08 34	10 01	11 23
54	18 11	18 46	19 28	07 08	08 40	10 10	11 34
56	18 11	18 48	19 32	07 11	08 46	10 19	11 46
58	18 12	18 51	19 37	07 15	08 53	10 30	12 00
S 60	18 12	18 53	19 43	07 19	09 02	10 43	12 17

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
20	07 43	07 34	12 08	00 13	12 41	16	99
21	07 25	07 16	12 07	01 08	13 37	17	95
22	07 07	06 58	12 07	02 05	14 34	18	89

UT	ARIES	VENUS −4.0		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
23 00	180 08.4	212 50.8	S13 38.6	187 04.7	S 4 04.1	167 49.4	N 4 06.3	345 27.5	S 3 19.2
01	195 10.9	227 50.3	37.8	202 05.4	03.3	182 51.3	06.6	0 30.2	19.1
02	210 13.4	242 49.8	36.9	217 06.0	02.5	197 53.2	06.8	15 32.8	19.0
03	225 15.8	257 49.3	36.0	232 06.7	01.7	212 55.1	07.0	30 35.4	19.0
04	240 18.3	272 48.8	35.1	247 07.4	01.0	227 57.1	07.3	45 38.1	18.9
05	255 20.8	287 48.3	34.2	262 08.0	4 00.2	242 59.0	07.5	60 40.7	18.8
06	270 23.2	302 47.8	S13 33.4	277 08.7	S 3 59.4	258 00.9	N 4 07.7	75 43.3	S 3 18.7
W 07	285 25.7	317 47.4	32.5	292 09.4	58.6	273 02.8	08.0	90 46.0	18.7
E 08	300 28.2	332 46.9	31.6	307 10.0	57.8	288 04.7	08.2	105 48.6	18.6
D 09	315 30.6	347 46.4	30.7	322 10.7	57.0	303 06.6	08.4	120 51.2	18.5
N 10	330 33.1	2 45.9	29.8	337 11.3	56.2	318 08.5	08.7	135 53.9	18.4
E 11	345 35.5	17 45.4	28.9	352 12.0	55.5	333 10.4	08.9	150 56.5	18.4
S 12	0 38.0	32 45.0	S13 28.1	7 12.7	S 3 54.7	348 12.3	N 4 09.2	165 59.1	S 3 18.3
D 13	15 40.5	47 44.5	27.2	22 13.3	53.9	3 14.2	09.4	181 01.8	18.2
A 14	30 42.9	62 44.0	26.3	37 14.0	53.1	18 16.2	09.6	196 04.4	18.1
Y 15	45 45.4	77 43.5	25.4	52 14.7	52.3	33 18.1	09.9	211 07.1	18.1
16	60 47.9	92 43.0	24.5	67 15.3	51.5	48 20.0	10.1	226 09.7	18.0
17	75 50.3	107 42.5	23.6	82 16.0	50.7	63 21.9	10.3	241 12.3	17.9
18	90 52.8	122 42.1	S13 22.7	97 16.7	S 3 50.0	78 23.8	N 4 10.6	256 15.0	S 3 17.8
19	105 55.3	137 41.6	21.8	112 17.3	49.2	93 25.7	10.8	271 17.6	17.8
20	120 57.7	152 41.1	21.0	127 18.0	48.4	108 27.6	11.0	286 20.2	17.7
21	136 00.2	167 40.6	20.1	142 18.7	47.6	123 29.5	11.3	301 22.9	17.6
22	151 02.7	182 40.1	19.2	157 19.3	46.8	138 31.4	11.5	316 25.5	17.5
23	166 05.1	197 39.7	18.3	172 20.0	46.0	153 33.3	11.7	331 28.1	17.5
24 00	181 07.6	212 39.2	S13 17.4	187 20.7	S 3 45.2	168 35.3	N 4 12.0	346 30.8	S 3 17.4
01	196 10.0	227 38.7	16.5	202 21.3	44.5	183 37.2	12.2	1 33.4	17.3
02	211 12.5	242 38.2	15.6	217 22.0	43.7	198 39.1	12.4	16 36.1	17.2
03	226 15.0	257 37.8	14.7	232 22.7	42.9	213 41.0	12.7	31 38.7	17.2
04	241 17.4	272 37.3	13.8	247 23.3	42.1	228 42.9	12.9	46 41.3	17.1
05	256 19.9	287 36.8	12.9	262 24.0	41.3	243 44.8	13.1	61 44.0	17.0
06	271 22.4	302 36.3	S13 12.0	277 24.7	S 3 40.5	258 46.7	N 4 13.4	76 46.6	S 3 16.9
T 07	286 24.8	317 35.9	11.1	292 25.3	39.7	273 48.6	13.6	91 49.2	16.9
H 08	301 27.3	332 35.4	10.2	307 26.0	39.0	288 50.5	13.8	106 51.9	16.8
U 09	316 29.8	347 34.9	09.3	322 26.7	38.2	303 52.4	14.1	121 54.5	16.7
R 10	331 32.2	2 34.4	08.4	337 27.3	37.4	318 54.3	14.3	136 57.1	16.6
S 11	346 34.7	17 34.0	07.5	352 28.0	36.6	333 56.3	14.6	151 59.8	16.6
D 12	1 37.2	32 33.5	S13 06.6	7 28.7	S 3 35.8	348 58.2	N 4 14.8	167 02.4	S 3 16.5
A 13	16 39.6	47 33.0	05.7	22 29.3	35.0	4 00.1	15.0	182 05.1	16.4
Y 14	31 42.1	62 32.5	04.8	37 30.0	34.2	19 02.0	15.3	197 07.7	16.3
15	46 44.5	77 32.1	03.9	52 30.7	33.5	34 03.9	15.5	212 10.3	16.2
16	61 47.0	92 31.6	03.0	67 31.3	32.7	49 05.8	15.7	227 13.0	16.2
17	76 49.5	107 31.1	02.1	82 32.0	31.9	64 07.7	16.0	242 15.6	16.1
18	91 51.9	122 30.6	S13 01.2	97 32.7	S 3 31.1	79 09.6	N 4 16.2	257 18.2	S 3 16.0
19	106 54.4	137 30.2	13 00.3	112 33.3	30.3	94 11.5	16.4	272 20.9	15.9
20	121 56.9	152 29.7	12 59.4	127 34.0	29.5	109 13.4	16.7	287 23.5	15.9
21	136 59.3	167 29.2	58.5	142 34.7	28.7	124 15.4	16.9	302 26.2	15.8
22	152 01.8	182 28.8	57.6	157 35.3	27.9	139 17.3	17.1	317 28.8	15.7
23	167 04.3	197 28.3	56.7	172 36.0	27.2	154 19.2	17.4	332 31.4	15.6
25 00	182 06.7	212 27.8	S12 55.8	187 36.7	S 3 26.4	169 21.1	N 4 17.6	347 34.1	S 3 15.6
01	197 09.2	227 27.3	54.9	202 37.3	25.6	184 23.0	17.8	2 36.7	15.5
02	212 11.6	242 26.9	54.0	217 38.0	24.8	199 24.9	18.1	17 39.3	15.4
03	227 14.1	257 26.4	53.0	232 38.7	24.0	214 26.8	18.3	32 42.0	15.3
04	242 16.6	272 25.9	52.1	247 39.3	23.2	229 28.7	18.5	47 44.6	15.3
05	257 19.0	287 25.5	51.2	262 40.0	22.4	244 30.6	18.8	62 47.3	15.2
06	272 21.5	302 25.0	S12 50.3	277 40.7	S 3 21.7	259 32.5	N 4 19.0	77 49.9	S 3 15.1
07	287 24.0	317 24.5	49.4	292 41.4	20.9	274 34.4	19.3	92 52.5	15.0
08	302 26.4	332 24.1	48.5	307 42.0	20.1	289 36.3	19.5	107 55.2	15.0
F 09	317 28.9	347 23.6	47.6	322 42.7	19.3	304 38.3	19.7	122 57.8	14.9
R 10	332 31.4	2 23.1	46.7	337 43.4	18.5	319 40.2	20.0	138 00.4	14.8
I 11	347 33.8	17 22.7	45.7	352 44.0	17.7	334 42.1	20.2	153 03.1	14.7
D 12	2 36.3	32 22.2	S12 44.8	7 44.7	S 3 16.9	349 44.0	N 4 20.4	168 05.7	S 3 14.7
A 13	17 38.8	47 21.7	43.9	22 45.4	16.1	4 45.9	20.7	183 08.4	14.6
Y 14	32 41.2	62 21.3	43.0	37 46.0	15.4	19 47.8	20.9	198 11.0	14.5
15	47 43.7	77 20.8	42.1	52 46.7	14.6	34 49.7	21.1	213 13.6	14.4
16	62 46.1	92 20.3	41.2	67 47.4	13.8	49 51.6	21.4	228 16.3	14.4
17	77 48.6	107 19.9	40.2	82 48.0	13.0	64 53.5	21.6	243 18.9	14.3
18	92 51.1	122 19.4	S12 39.3	97 48.7	S 3 12.2	79 55.4	N 4 21.8	258 21.5	S 3 14.2
19	107 53.5	137 18.9	38.4	112 49.4	11.4	94 57.3	22.1	273 24.2	14.1
20	122 56.0	152 18.5	37.5	127 50.1	10.6	109 59.3	22.3	288 26.8	14.0
21	137 58.5	167 18.0	36.6	142 50.7	09.8	125 01.2	22.5	303 29.5	14.0
22	153 00.9	182 17.5	35.6	157 51.4	09.1	140 03.1	22.8	318 32.1	13.9
23	168 03.4	197 17.1	34.7	172 52.1	08.3	155 05.0	23.0	333 34.7	13.8
	h m								
Mer. Pass.	11 53.5	*v* −0.5	*d* 0.9	*v* 0.7	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.8
Achernar	335 28.4	S57 10.9
Acrux	173 10.5	S63 09.8
Adhara	255 13.7	S28 59.6
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.4	N55 53.7
Alkaid	152 59.6	N49 15.2
Al Na'ir	27 46.0	S46 54.2
Alnilam	275 48.0	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.1	N26 40.3
Alpheratz	357 45.5	N29 09.1
Altair	62 09.9	N 8 53.8
Ankaa	353 17.6	S42 14.7
Antares	112 28.1	S26 27.4
Arcturus	145 56.9	N19 07.2
Atria	107 31.2	S69 02.6
Avior	234 18.4	S59 33.1
Bellatrix	278 33.8	N 6 21.5
Betelgeuse	271 03.0	N 7 24.4
Canopus	263 56.8	S52 42.5
Capella	280 36.9	N46 00.6
Deneb	49 32.9	N45 19.0
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.5
Dubhe	193 52.9	N61 41.3
Elnath	278 14.7	N28 37.0
Eltanin	90 46.8	N51 28.9
Enif	33 48.9	N 9 55.5
Fomalhaut	15 26.0	S29 33.7
Gacrux	172 02.2	S57 10.7
Gienah	175 53.6	S17 36.5
Hadar	148 49.7	S60 25.6
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.9	S34 22.6
Kochab	137 18.9	N74 06.3
Markab	13 40.2	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.5	S69 46.1
Mirfak	308 43.0	N49 54.2
Nunki	76 00.3	S26 16.9
Peacock	53 22.0	S56 41.7
Pollux	243 29.5	N27 59.9
Procyon	245 01.3	N 5 11.6
Rasalhague	96 07.9	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.7	S 8 11.5
Rigil Kent.	139 53.5	S60 52.8
Sabik	102 14.3	S15 44.4
Schedar	349 43.0	N56 36.0
Shaula	96 24.0	S37 06.6
Sirius	258 35.1	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.4	S43 29.0
Vega	80 40.1	N38 47.4
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	31 31.6	9 50
Mars	6 13.1	11 30
Jupiter	347 27.7	12 44
Saturn	165 23.2	0 54

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
23 00	178 17.7	N 0 48.0	315 54.6	5.8	S20 11.1	7.9	59.9
01	193 17.9	49.0	330 19.4	5.8	20 19.0	7.8	59.9
02	208 18.1	50.0	344 44.2	5.8	20 26.8	7.6	59.8
03	223 18.3	51.0	359 09.0	5.7	20 34.4	7.5	59.8
04	238 18.5	52.0	13 33.7	5.7	20 41.9	7.3	59.8
05	253 18.7	52.9	27 58.4	5.8	20 49.2	7.2	59.7
06	268 18.9	N 0 53.9	42 23.2	5.7	S20 56.4	7.0	59.7
W 07	283 19.1	54.9	56 47.9	5.7	21 03.4	6.9	59.7
E 08	298 19.2	55.9	71 12.6	5.7	21 10.3	6.8	59.6
D 09	313 19.4	56.9	85 37.3	5.7	21 17.1	6.6	59.6
N 10	328 19.6	57.9	100 02.0	5.7	21 23.7	6.4	59.5
E 11	343 19.8	58.9	114 26.7	5.7	21 30.1	6.3	59.5
S 12	358 20.0	N 0 59.8	128 51.4	5.6	S21 36.4	6.1	59.5
D 13	13 20.2	1 00.8	143 16.0	5.7	21 42.5	6.0	59.4
A 14	28 20.4	01.8	157 40.7	5.7	21 48.5	5.9	59.4
Y 15	43 20.6	02.8	172 05.4	5.7	21 54.4	5.6	59.4
16	58 20.8	03.8	186 30.1	5.7	22 00.0	5.6	59.3
17	73 20.9	04.8	200 54.8	5.7	22 05.6	5.3	59.3
18	88 21.1	N 1 05.8	215 19.5	5.7	S22 10.9	5.3	59.2
19	103 21.3	06.7	229 44.2	5.7	22 16.2	5.0	59.2
20	118 21.5	07.7	244 08.9	5.7	22 21.2	5.0	59.2
21	133 21.7	08.7	258 33.6	5.7	22 26.2	4.7	59.1
22	148 21.9	09.7	272 58.3	5.7	22 30.9	4.6	59.1
23	163 22.1	10.7	287 23.0	5.7	22 35.5	4.5	59.0
24 00	178 22.3	N 1 11.7	301 47.7	5.8	S22 40.0	4.3	59.0
01	193 22.4	12.7	316 12.5	5.8	22 44.3	4.2	59.0
02	208 22.6	13.6	330 37.3	5.7	22 48.5	4.0	58.9
03	223 22.8	14.6	345 02.0	5.8	22 52.5	3.8	58.9
04	238 23.0	15.6	359 26.8	5.9	22 56.3	3.7	58.8
05	253 23.2	16.6	13 51.7	5.8	23 00.0	3.5	58.8
06	268 23.4	N 1 17.6	28 16.5	5.9	S23 03.5	3.4	58.8
07	283 23.6	18.6	42 41.4	5.8	23 06.9	3.3	58.7
T 08	298 23.8	19.5	57 06.2	6.0	23 10.2	3.0	58.7
H 09	313 24.0	20.5	71 31.2	5.9	23 13.2	3.0	58.6
U 10	328 24.1	21.5	85 56.1	5.9	23 16.2	2.7	58.6
R 11	343 24.3	22.5	100 21.0	6.0	23 18.9	2.6	58.6
S 12	358 24.5	N 1 23.5	114 46.0	6.0	S23 21.5	2.5	58.5
D 13	13 24.7	24.5	129 11.0	6.1	23 24.0	2.3	58.5
A 14	28 24.9	25.5	143 36.1	6.1	23 26.3	2.2	58.4
Y 15	43 25.1	26.4	158 01.2	6.1	23 28.5	2.0	58.4
16	58 25.3	27.4	172 26.3	6.1	23 30.5	1.9	58.4
17	73 25.5	28.4	186 51.4	6.2	23 32.4	1.7	58.3
18	88 25.7	N 1 29.4	201 16.6	6.3	S23 34.1	1.5	58.3
19	103 25.8	30.4	215 41.9	6.2	23 35.6	1.4	58.2
20	118 26.0	31.4	230 07.1	6.3	23 37.0	1.3	58.2
21	133 26.2	32.3	244 32.4	6.4	23 38.3	1.1	58.2
22	148 26.4	33.3	258 57 8	6.3	23 39.4	1.0	58.1
23	163 26.6	34.3	273 23.1	6.5	23 40.4	0.8	58.1
25 00	178 26.8	N 1 35.3	287 48.6	6.5	S23 41.2	0.6	58.0
01	193 27.0	36.3	302 14.1	6.5	23 41.8	0.6	58.0
02	208 27.2	37.3	316 39.6	6.6	23 42.4	0.3	58.0
03	223 27.4	38.2	331 05.2	6.6	23 42.7	0.3	57.9
04	238 27.5	39.2	345 30.8	6.7	23 43.0	0.0	57.9
05	253 27.7	40.2	359 56.5	6.7	23 43.0	0.0	57.8
06	268 27.9	N 1 41.2	14 22.2	6.8	S23 43.0	0.2	57.8
07	283 28.1	42.2	28 48.0	6.8	23 42.8	0.4	57.8
08	298 28.3	43.2	43 13.8	6.9	23 42.4	0.5	57.7
F 09	313 28.5	44.1	57 39.7	6.9	23 41.9	0.6	57.7
R 10	328 28.7	45.1	72 05.6	7.0	23 41.3	0.8	57.6
I 11	343 28.9	46.1	86 31.6	7.1	23 40.5	0.9	57.6
D 12	358 29.1	N 1 47.1	100 57.7	7.1	S23 39.6	1.1	57.6
A 13	13 29.2	48.1	115 23.8	7.2	23 38.5	1.2	57.5
Y 14	28 29.4	49.1	129 50.0	7.2	23 37.3	1.3	57.5
15	43 29.6	50.0	144 16.2	7.3	23 36.0	1.5	57.5
16	58 29.8	51.0	158 42.5	7.4	23 34.5	1.6	57.4
17	73 30.0	52.0	173 08.9	7.4	23 32.9	1.8	57.4
18	88 30.2	N 1 53.0	187 35.3	7.5	S23 31.1	1.9	57.3
19	103 30.4	54.0	202 01.8	7.6	23 29.2	2.0	57.3
20	118 30.6	55.0	216 28.4	7.6	23 27.2	2.1	57.3
21	133 30.8	55.9	230 55.0	7.7	23 25.1	2.3	57.2
22	148 30.9	56.9	245 21.7	7.7	23 22.8	2.5	57.2
23	163 31.1	57.9	259 48.4	7.9	S23 20.3	2.5	57.1
	SD 16.1	d 1.0	SD	16.2	15.9		15.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 23	Moonrise 24	Moonrise 25	Moonrise 26
°	h m	h m	h m	h m	h m	h m	h m
N 72	02 56	04 31	05 40	▬	▬	▬	▬
N 70	03 19	04 40	05 42	▬	▬	▬	▬
68	03 36	04 48	05 45	01 32	▬	▬	▬
66	03 50	04 55	05 47	00 46	02 50	04 32	04 50
64	04 01	05 00	05 48	00 16	01 59	03 16	03 58
62	04 11	05 05	05 50	25 27	01 27	02 40	03 26
60	04 18	05 09	05 51	25 03	01 03	02 14	03 02
N 58	04 25	05 13	05 52	24 45	00 45	01 53	02 43
56	04 31	05 16	05 53	24 29	00 29	01 36	02 27
54	04 36	05 18	05 54	24 15	00 15	01 22	02 14
52	04 41	05 21	05 54	24 03	00 03	01 09	02 02
50	04 45	05 23	05 55	23 53	24 58	00 58	01 51
45	04 53	05 27	05 57	23 31	24 35	00 35	01 29
N 40	04 59	05 31	05 58	23 14	24 17	00 17	01 11
35	05 04	05 33	05 59	22 59	24 01	00 01	00 56
30	05 08	05 36	06 00	22 46	23 48	24 43	00 43
20	05 13	05 39	06 01	22 25	23 25	24 20	00 20
N 10	05 17	05 41	06 02	22 06	23 05	24 01	00 01
0	05 18	05 42	06 03	21 48	22 47	23 43	24 36
S 10	05 19	05 43	06 04	21 31	22 28	23 25	24 20
20	05 17	05 43	06 05	21 12	22 08	23 05	24 02
30	05 14	05 42	06 06	20 51	21 46	22 43	23 41
35	05 11	05 41	06 06	20 39	21 32	22 30	23 29
40	05 08	05 39	06 06	20 24	21 17	22 15	23 16
45	05 03	05 38	06 07	20 08	20 59	21 57	22 59
S 50	04 57	05 35	06 07	19 47	20 36	21 34	22 39
52	04 54	05 34	06 08	19 37	20 25	21 24	22 29
54	04 51	05 33	06 08	19 26	20 13	21 12	22 18
56	04 47	05 31	06 08	19 13	19 59	20 58	22 06
58	04 43	05 29	06 08	18 59	19 43	20 41	21 52
S 60	04 38	05 27	06 09	18 42	19 23	20 22	21 35

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 23	Moonset 24	Moonset 25	Moonset 26
°	h m	h m	h m	h m	h m	h m	h m
N 72	18 36	19 46	21 23	▬	▬	▬	▬
N 70	18 33	19 35	20 58	▬	▬	▬	▬
68	18 30	19 27	20 40	04 23	▬	▬	▬
66	18 28	19 20	20 26	05 10	05 09	05 28	07 07
64	18 26	19 14	20 14	05 41	06 01	06 44	07 58
62	18 25	19 09	20 04	06 04	06 33	07 21	08 30
60	18 23	19 05	19 56	06 23	06 57	07 47	08 54
N 58	18 22	19 02	19 49	06 39	07 16	08 07	09 13
56	18 21	18 59	19 43	06 52	07 32	08 24	09 28
54	18 20	18 56	19 38	07 04	07 45	08 39	09 42
52	18 19	18 53	19 34	07 14	07 57	08 51	09 54
50	18 19	18 51	19 29	07 23	08 08	09 02	10 04
45	18 17	18 46	19 21	07 42	08 30	09 25	10 26
N 40	18 16	18 43	19 15	07 58	08 48	09 44	10 43
35	18 15	18 40	19 09	08 12	09 03	09 59	10 58
30	18 14	18 38	19 05	08 23	09 16	10 13	11 11
20	18 12	18 34	19 00	08 44	09 39	10 36	11 33
N 10	18 11	18 32	18 56	09 01	09 58	10 55	11 51
0	18 10	18 30	18 54	09 18	10 16	11 14	12 09
S 10	18 09	18 30	18 54	09 34	10 34	11 32	12 26
20	18 08	18 30	18 55	09 52	10 54	11 52	12 45
30	18 07	18 31	18 58	10 12	11 16	12 15	13 06
35	18 06	18 31	19 01	10 24	11 29	12 28	13 19
40	18 06	18 33	19 04	10 37	11 44	12 43	13 33
45	18 05	18 34	19 08	10 54	12 02	13 01	13 50
S 50	18 04	18 37	19 14	11 14	12 25	13 24	14 11
52	18 04	18 38	19 17	11 23	12 36	13 35	14 21
54	18 04	18 39	19 20	11 34	12 48	13 47	14 32
56	18 03	18 40	19 24	11 46	13 02	14 01	14 45
58	18 03	18 42	19 28	12 00	13 18	14 17	14 59
S 60	18 03	18 44	19 33	12 17	13 37	14 37	15 17

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
23	06 49	06 40	12 07	03 04	15 33	19	81
24	06 31	06 22	12 06	04 02	16 31	20	71
25	06 13	06 04	12 06	05 00	17 28	21	61

UT	ARIES	VENUS −4.0		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
26 00	183 05.9	212 16.6	S12 33.8	187 52.7	S 3 07.5	170 06.9	N 4 23.2	348 37.4	S 3 13.7
01	198 08.3	227 16.2	32.9	202 53.4	06.7	185 08.8	23.5	3 40.0	13.7
02	213 10.8	242 15.7	31.9	217 54.1	05.9	200 10.7	23.7	18 42.7	13.6
03	228 13.3	257 15.2	31.0	232 54.7	05.1	215 12.6	23.9	33 45.3	13.5
04	243 15.7	272 14.8	30.1	247 55.4	04.3	230 14.5	24.2	48 47.9	13.4
05	258 18.2	287 14.3	29.2	262 56.1	03.5	245 16.4	24.4	63 50.6	13.4
06	273 20.6	302 13.8	S12 28.2	277 56.8	S 3 02.8	260 18.3	N 4 24.7	78 53.2	S 3 13.3
07	288 23.1	317 13.4	27.3	292 57.4	02.0	275 20.2	24.9	93 55.8	13.2
S 08	303 25.6	332 12.9	26.4	307 58.1	01.2	290 22.2	25.1	108 58.5	13.1
A 09	318 28.0	347 12.5	25.4	322 58.8	3 00.4	305 24.1	25.4	124 01.1	13.1
T 10	333 30.5	2 12.0	24.5	337 59.4	2 59.6	320 26.0	25.6	139 03.8	13.0
U 11	348 33.0	17 11.5	23.6	353 00.1	58.8	335 27.9	25.8	154 06.4	12.9
R 12	3 35.4	32 11.1	S12 22.7	8 00.8	S 2 58.0	350 29.8	N 4 26.1	169 09.0	S 3 12.8
D 13	18 37.9	47 10.6	21.7	23 01.4	57.2	5 31.7	26.3	184 11.7	12.8
A 14	33 40.4	62 10.2	20.8	38 02.1	56.5	20 33.6	26.5	199 14.3	12.7
Y 15	48 42.8	77 09.7	19.9	53 02.8	55.7	35 35.5	26.8	214 17.0	12.6
16	63 45.3	92 09.3	18.9	68 03.5	54.9	50 37.4	27.0	229 19.6	12.5
17	78 47.8	107 08.8	18.0	83 04.1	54.1	65 39.3	27.2	244 22.2	12.4
18	93 50.2	122 08.3	S12 17.1	98 04.8	S 2 53.3	80 41.2	N 4 27.5	259 24.9	S 3 12.4
19	108 52.7	137 07.9	16.1	113 05.5	52.5	95 43.1	27.7	274 27.5	12.3
20	123 55.1	152 07.4	15.2	128 06.1	51.7	110 45.0	27.9	289 30.2	12.2
21	138 57.6	167 07.0	14.3	143 06.8	50.9	125 47.0	28.2	304 32.8	12.1
22	154 00.1	182 06.5	13.3	158 07.5	50.2	140 48.9	28.4	319 35.4	12.1
23	169 02.5	197 06.1	12.4	173 08.2	49.4	155 50.8	28.6	334 38.1	12.0
27 00	184 05.0	212 05.6	S12 11.4	188 08.8	S 2 48.6	170 52.7	N 4 28.9	349 40.7	S 3 11.9
01	199 07.5	227 05.1	10.5	203 09.5	47.8	185 54.6	29.1	4 43.4	11.8
02	214 09.9	242 04.7	09.6	218 10.2	47.0	200 56.5	29.3	19 46.0	11.8
03	229 12.4	257 04.2	08.6	233 10.8	46.2	215 58.4	29.6	34 48.6	11.7
04	244 14.9	272 03.8	07.7	248 11.5	45.4	231 00.3	29.8	49 51.3	11.6
05	259 17.3	287 03.3	06.7	263 12.2	44.6	246 02.2	30.1	64 53.9	11.5
06	274 19.8	302 02.9	S12 05.8	278 12.9	S 2 43.9	261 04.1	N 4 30.3	79 56.5	S 3 11.5
07	289 22.3	317 02.4	04.9	293 13.5	43.1	276 06.0	30.5	94 59.2	11.4
08	304 24.7	332 02.0	03.9	308 14.2	42.3	291 07.9	30.8	110 01.8	11.3
S 09	319 27.2	347 01.5	03.0	323 14.9	41.5	306 09.8	31.0	125 04.5	11.2
U 10	334 29.6	2 01.1	02.0	338 15.6	40.7	321 11.7	31.2	140 07.1	11.2
N 11	349 32.1	17 00.6	01.1	353 16.2	39.9	336 13.7	31.5	155 09.7	11.1
D 12	4 34.6	32 00.2	S12 00.1	8 16.9	S 2 39.1	351 15.6	N 4 31.7	170 12.4	S 3 11.0
A 13	19 37.0	46 59.7	11 59.2	23 17.6	38.3	6 17.5	31.9	185 15.0	10.9
Y 14	34 39.5	61 59.3	58.2	38 18.2	37.5	21 19.4	32.2	200 17.7	10.8
15	49 42.0	76 58.8	57.3	53 18.9	36.8	36 21.3	32.4	215 20.3	10.8
16	64 44.4	91 58.4	56.4	68 19.6	36.0	51 23.2	32.6	230 22.9	10.7
17	79 46.9	106 57.9	55.4	83 20.3	35.2	66 25.1	32.9	245 25.6	10.6
18	94 49.4	121 57.5	S11 54.5	98 20.9	S 2 34.4	81 27.0	N 4 33.1	260 28.2	S 3 10.5
19	109 51.8	136 57.0	53.5	113 21.6	33.6	96 28.9	33.3	275 30.9	10.5
20	124 54.3	151 56.6	52.6	128 22.3	32.8	111 30.8	33.6	290 33.5	10.4
21	139 56.7	166 56.1	51.6	143 23.0	32.0	126 32.7	33.8	305 36.1	10.3
22	154 59.2	181 55.7	50.7	158 23.6	31.2	141 34.6	34.0	320 38.8	10.2
23	170 01.7	196 55.2	49.7	173 24.3	30.5	156 36.5	34.3	335 41.4	10.2
28 00	185 04.1	211 54.8	S11 48.8	188 25.0	S 2 29.7	171 38.4	N 4 34.5	350 44.1	S 3 10.1
01	200 06.6	226 54.3	47.8	203 25.7	28.9	186 40.4	34.7	5 46.7	10.0
02	215 09.1	241 53.9	46.8	218 26.3	28.1	201 42.3	35.0	20 49.3	09.9
03	230 11.5	256 53.4	45.9	233 27.0	27.3	216 44.2	35.2	35 52.0	09.9
04	245 14.0	271 53.0	44.9	248 27.7	26.5	231 46.1	35.4	50 54.6	09.8
05	260 16.5	286 52.5	44.0	263 28.3	25.7	246 48.0	35.7	65 57.3	09.7
06	275 18.9	301 52.1	S11 43.0	278 29.0	S 2 24.9	261 49.9	N 4 35.9	80 59.9	S 3 09.6
07	290 21.4	316 51.6	42.1	293 29.7	24.1	276 51.8	36.2	96 02.5	09.5
08	305 23.9	331 51.2	41.1	308 30.4	23.4	291 53.7	36.4	111 05.2	09.5
M 09	320 26.3	346 50.8	40.2	323 31.0	22.6	306 55.6	36.6	126 07.8	09.4
O 10	335 28.8	1 50.3	39.2	338 31.7	21.8	321 57.5	36.9	141 10.5	09.3
N 11	350 31.2	16 49.9	38.2	353 32.4	21.0	336 59.4	37.1	156 13.1	09.2
D 12	5 33.7	31 49.4	S11 37.3	8 33.1	S 2 20.2	352 01.3	N 4 37.3	171 15.8	S 3 09.2
A 13	20 36.2	46 49.0	36.3	23 33.7	19.4	7 03.2	37.6	186 18.4	09.1
Y 14	35 38.6	61 48.5	35.4	38 34.4	18.6	22 05.1	37.8	201 21.0	09.0
15	50 41.1	76 48.1	34.4	53 35.1	17.8	37 07.0	38.0	216 23.7	08.9
16	65 43.6	91 47.7	33.4	68 35.8	17.0	52 09.0	38.3	231 26.3	08.9
17	80 46.0	106 47.2	32.5	83 36.4	16.3	67 10.9	38.5	246 29.0	08.8
18	95 48.5	121 46.8	S11 31.5	98 37.1	S 2 15.5	82 12.8	N 4 38.7	261 31.6	S 3 08.7
19	110 51.0	136 46.3	30.6	113 37.8	14.7	97 14.7	39.0	276 34.2	08.6
20	125 53.4	151 45.9	29.6	128 38.5	13.9	112 16.6	39.2	291 36.9	08.6
21	140 55.9	166 45.4	28.6	143 39.1	13.1	127 18.5	39.4	306 39.5	08.5
22	155 58.4	181 45.0	27.7	158 39.8	12.3	142 20.4	39.7	321 42.2	08.4
23	171 00.8	196 44.6	26.7	173 40.5	11.5	157 22.3	39.9	336 44.8	08.3
	h m								
Mer. Pass.	11 41.7	*v* −0.5	*d* 0.9	*v* 0.7	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.8
Achernar	335 28.4	S57 10.8
Acrux	173 10.5	S63 09.9
Adhara	255 13.7	S28 59.6
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.4	N55 53.7
Alkaid	152 59.6	N49 15.2
Al Na'ir	27 46.0	S46 54.2
Alnilam	275 48.0	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.1	N26 40.3
Alpheratz	357 45.5	N29 09.1
Altair	62 09.9	N 8 53.8
Ankaa	353 17.6	S42 14.7
Antares	112 28.0	S26 27.4
Arcturus	145 56.9	N19 07.2
Atria	107 31.2	S69 02.6
Avior	234 18.4	S59 33.1
Bellatrix	278 33.8	N 6 21.5
Betelgeuse	271 03.1	N 7 24.4
Canopus	263 56.9	S52 42.5
Capella	280 36.9	N46 00.6
Deneb	49 32.9	N45 19.0
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.5
Dubhe	193 52.9	N61 41.3
Elnath	278 14.7	N28 37.0
Eltanin	90 46.8	N51 28.9
Enif	33 48.9	N 9 55.5
Fomalhaut	15 26.0	S29 33.7
Gacrux	172 02.2	S57 10.7
Gienah	175 53.6	S17 36.5
Hadar	148 49.7	S60 25.7
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.9	S34 22.6
Kochab	137 18.8	N74 06.3
Markab	13 40.2	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.1	S36 25.6
Miaplacidus	221 39.6	S69 46.2
Mirfak	308 43.0	N49 54.2
Nunki	76 00.3	S26 16.9
Peacock	53 21.9	S56 41.7
Pollux	243 29.5	N27 59.9
Procyon	245 01.3	N 5 11.6
Rasalhague	96 07.8	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.7	S 8 11.5
Rigil Kent.	139 53.4	S60 52.8
Sabik	102 14.3	S15 44.4
Schedar	349 43.0	N56 36.0
Shaula	96 24.0	S37 06.6
Sirius	258 35.1	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.4	S43 29.0
Vega	80 40.1	N38 47.4
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	28 00.6	9 52
Mars	4 03.8	11 27
Jupiter	346 47.7	12 35
Saturn	165 35.7	0 41

UT	SUN			MOON					Lat.	Twilight		Sunrise	Moonrise			
	GHA	Dec		GHA	v	Dec	d	HP		Naut.	Civil		26	27	28	29
d h	° ′	° ′		° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
26 00	178 31.3	N 1 58.9		274 15.3	7.9	S23 17.8	2.7	57.1	N 72	02 32	04 13	05 24	▬	▬	▬	05 54
01	193 31.5	1 59.9		288 42.2	7.9	23 15.1	2.8	57.1	N 70	03 00	04 25	05 29	▬	▬	05 56	05 24
02	208 31.7	2 00.8		303 09.1	8.1	23 12.3	2.9	57.0	68	03 20	04 35	05 32	▬	05 42	05 15	05 01
03	223 31.9	. . 01.8		317 36.2	8.1	23 09.4	3.1	57.0	66	03 36	04 43	05 35	04 50	04 49	04 47	04 44
04	238 32.1	02.8		332 03.3	8.2	23 06.3	3.2	57.0	64	03 49	04 49	05 38	03 58	04 17	04 25	04 29
05	253 32.3	03.8		346 30.5	8.3	23 03.1	3.3	56.9	62	03 59	04 55	05 40	03 26	03 53	04 08	04 17
06	268 32.5	N 2 04.8		0 57.8	8.3	S22 59.8	3.5	56.9	60	04 08	05 00	05 42	03 02	03 33	03 53	04 06
07	283 32.6	05.8		15 25.1	8.4	22 56.3	3.6	56.9	N 58	04 16	05 04	05 43	02 43	03 17	03 41	03 57
S 08	298 32.8	06.7		29 52.5	8.5	22 52.7	3.6	56.8	56	04 22	05 07	05 45	02 27	03 04	03 30	03 49
A 09	313 33.0	. . 07.7		44 20.0	8.6	22 49.1	3.9	56.8	54	04 28	05 11	05 46	02 14	02 52	03 20	03 42
T 10	328 33.2	08.7		58 47.6	8.6	22 45.2	3.9	56.7	52	04 33	05 14	05 47	02 02	02 42	03 12	03 36
U 11	343 33.4	09.7		73 15.2	8.7	22 41.3	4.1	56.7	50	04 38	05 16	05 49	01 51	02 32	03 04	03 30
R 12	358 33.6	N 2 10.7		87 42.9	8.8	S22 37.2	4.1	56.7	45	04 47	05 22	05 51	01 29	02 12	02 48	03 17
D 13	13 33.8	11.6		102 10.7	8.9	22 33.1	4.3	56.6	N 40	04 54	05 26	05 53	01 11	01 56	02 34	03 07
A 14	28 34.0	12.6		116 38.6	9.0	22 28.8	4.4	56.6	35	05 00	05 29	05 55	00 56	01 43	02 23	02 58
Y 15	43 34.2	. . 13.6		131 06.6	9.0	22 24.4	4.6	56.6	30	05 04	05 32	05 56	00 43	01 31	02 13	02 50
16	58 34.3	14.6		145 34.6	9.1	22 19.8	4.6	56.5	20	05 11	05 36	05 58	00 20	01 11	01 56	02 36
17	73 34.5	15.6		160 02.7	9.2	22 15.2	4.8	56.5	N 10	05 15	05 39	06 00	00 01	00 53	01 41	02 24
18	88 34.7	N 2 16.6		174 30.9	9.3	S22 10.4	4.8	56.5	0	05 18	05 42	06 02	24 36	00 36	01 26	02 13
19	103 34.9	17.5		188 59.2	9.3	22 05.6	5.0	56.4	S 10	05 19	05 43	06 04	24 20	00 20	01 12	02 02
20	118 35.1	18.5		203 27.5	9.5	22 00.6	5.1	56.4	20	05 18	05 44	06 06	24 02	00 02	00 57	01 50
21	133 35.3	. . 19.5		217 56.0	9.5	21 55.5	5.2	56.4	30	05 16	05 44	06 07	23 41	24 39	00 39	01 36
22	148 35.5	20.5		232 24.5	9.6	21 50.3	5.3	56.3	35	05 14	05 43	06 08	23 29	24 29	00 29	01 28
23	163 35.7	21.5		246 53.1	9.7	21 45.0	5.5	56.3	40	05 11	05 42	06 09	23 16	24 17	00 17	01 18
27 00	178 35.9	N 2 22.4		261 21.8	9.7	S21 39.5	5.5	56.3	45	05 07	05 41	06 11	22 59	24 03	00 03	01 07
01	193 36.0	23.4		275 50.5	9.9	21 34.0	5.6	56.2	S 50	05 02	05 40	06 12	22 39	23 46	24 54	00 54
02	208 36.2	24.4		290 19.4	9.9	21 28.4	5.8	56.2	52	05 00	05 39	06 13	22 29	23 38	24 48	00 48
03	223 36.4	. . 25.4		304 48.3	10.0	21 22.6	5.8	56.2	54	04 57	05 38	06 14	22 18	23 29	24 41	00 41
04	238 36.6	26.4		319 17.3	10.1	21 16.8	6.0	56.1	56	04 54	05 37	06 14	22 06	23 19	24 34	00 34
05	253 36.8	27.3		333 46.4	10.1	21 10.8	6.0	56.1	58	04 50	05 36	06 15	21 52	23 08	24 25	00 25
06	268 37.0	N 2 28.3		348 15.5	10.3	S21 04.8	6.2	56.1	S 60	04 46	05 35	06 16	21 35	22 54	24 15	00 15
07	283 37.2	29.3		2 44.8	10.3	20 58.6	6.2	56.0								
08	298 37.4	30.3		17 14.1	10.4	20 52.4	6.4	56.0								
S 09	313 37.6	. . 31.3		31 43.5	10.5	20 46.0	6.4	56.0								
U 10	328 37.7	32.2		46 13.0	10.6	20 39.6	6.6	56.0								
N 11	343 37.9	33.2		60 42.6	10.6	20 33.0	6.6	55.9								
D 12	358 38.1	N 2 34.2		75 12.2	10.8	S20 26.4	6.8	55.9								
A 13	13 38.3	35.2		89 42.0	10.8	20 19.6	6.8	55.9								
Y 14	28 38.5	36.1		104 11.8	10.9	20 12.8	6.9	55.8								
15	43 38.7	. . 37.1		118 41.7	11.0	20 05.9	7.1	55.8								
16	58 38.9	38.1		133 11.7	11.0	19 58.8	7.1	55.8								
17	73 39.1	39.1		147 41.7	11.2	19 51.7	7.2	55.7								
18	88 39.3	N 2 40.1		162 11.9	11.2	S19 44.5	7.3	55.7								
19	103 39.4	41.0		176 42.1	11.3	19 37.2	7.3	55.7								
20	118 39.6	42.0		191 12.4	11.4	19 29.9	7.5	55.7								
21	133 39.8	. . 43.0		205 42.8	11.5	19 22.4	7.6	55.6								
22	148 40.0	44.0		220 13.3	11.5	19 14.8	7.6	55.6								
23	163 40.2	45.0		234 43.8	11.6	19 07.2	7.7	55.6								
28 00	178 40.4	N 2 45.9		249 14.4	11.7	S18 59.5	7.8	55.6								
01	193 40.6	46.9		263 45.1	11.8	18 51.7	7.9	55.5								
02	208 40.8	47.9		278 15.9	11.9	18 43.8	8.0	55.5								
03	223 40.9	. . 48.9		292 46.8	11.9	18 35.8	8.0	55.5								
04	238 41.1	49.8		307 17.7	12.0	18 27.8	8.1	55.4								
05	253 41.3	50.8		321 48.7	12.1	18 19.7	8.2	55.4								
06	268 41.5	N 2 51.8		336 19.8	12.2	S18 11.5	8.3	55.4								
07	283 41.7	52.8		350 51.0	12.3	18 03.2	8.4	55.4								
08	298 41.9	53.8		5 22.3	12.3	17 54.8	8.4	55.3								
M 09	313 42.1	. . 54.7		19 53.6	12.4	17 46.4	8.5	55.3								
O 10	328 42.3	55.7		34 25.0	12.4	17 37.9	8.6	55.3								
N 11	343 42.5	56.7		48 56.4	12.6	17 29.3	8.7	55.3								
D 12	358 42.6	N 2 57.7		63 28.0	12.6	S17 20.6	8.7	55.2								
A 13	13 42.8	58.6		77 59.6	12.7	17 11.9	8.8	55.2								
Y 14	28 43.0	2 59.6		92 31.3	12.8	17 03.1	8.9	55.2								
15	43 43.2	3 00.6		107 03.1	12.8	16 54.2	8.9	55.2								
16	58 43.4	01.6		121 34.9	12.9	16 45.3	9.0	55.1								
17	73 43.6	02.6		136 06.8	13.0	16 36.3	9.1	55.1								
18	88 43.8	N 3 03.5		150 38.8	13.1	S16 27.2	9.1	55.1								
19	103 44.0	04.5		165 10.9	13.1	16 18.1	9.2	55.1								
20	118 44.2	05.5		179 43.0	13.2	16 08.9	9 3	55.1								
21	133 44.3	. . 06.5		194 15.2	13.2	15 59.6	9.3	55.0								
22	148 44.5	07.4		208 47.4	13.4	15 50.3	9.4	55.0								
23	163 44.7	08.4		223 19.8	13.4	S15 40.9	9.4	55.0								
	SD 16.1	d 1.0		SD	15.4		15.2									

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	26	27	28	29
°	h m	h m	h m	h m	h m	h m	h m
N 72	18 49	20 01	21 46	▬	▬	▬	11 13
N 70	18 45	19 49	21 16	▬	▬	09 34	11 41
68	18 41	19 39	20 55	▬	08 05	10 14	12 03
66	18 38	19 30	20 38	07 07	08 57	10 41	12 19
64	18 35	19 24	20 25	07 58	09 29	11 02	12 33
62	18 33	19 18	20 14	08 30	09 53	11 19	12 44
60	18 31	19 13	20 05	08 54	10 11	11 33	12 53
N 58	18 29	19 09	19 57	09 13	10 27	11 44	13 02
56	18 27	19 05	19 50	09 28	10 40	11 55	13 09
54	18 26	19 02	19 44	09 42	10 52	12 04	13 16
52	18 25	18 59	19 39	09 54	11 02	12 12	13 21
50	18 23	18 56	19 35	10 04	11 11	12 19	13 27
45	18 21	18 50	19 25	10 26	11 30	12 34	13 38
N 40	18 19	18 46	19 18	10 43	11 45	12 47	13 47
35	18 17	18 42	19 12	10 58	11 58	12 57	13 55
30	18 15	18 39	19 07	11 11	12 09	13 07	14 02
20	18 13	18 35	19 01	11 33	12 29	13 22	14 14
N 10	18 11	18 32	18 56	11 51	12 45	13 36	14 25
0	18 09	18 29	18 53	12 09	13 01	13 49	14 34
S 10	18 07	18 28	18 52	12 26	13 16	14 02	14 44
20	18 05	18 27	18 53	12 45	13 33	14 16	14 54
30	18 03	18 27	18 55	13 06	13 52	14 31	15 06
35	18 02	18 27	18 57	13 19	14 02	14 40	15 13
40	18 01	18 28	18 59	13 33	14 15	14 50	15 20
45	17 59	18 29	19 03	13 50	14 30	15 02	15 29
S 50	17 58	18 30	19 08	14 11	14 48	15 16	15 40
52	17 57	18 31	19 10	14 21	14 56	15 23	15 45
54	17 56	18 31	19 13	14 32	15 05	15 30	15 50
56	17 56	18 32	19 16	14 45	15 16	15 39	15 56
58	17 55	18 34	19 19	14 59	15 28	15 48	16 02
S 60	17 54	18 35	19 24	15 17	15 42	15 58	16 10

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00h	12h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
26	05 55	05 46	12 06	05 56	18 23	22	50
27	05 37	05 28	12 05	06 49	19 14	23	40
28	05 19	05 10	12 05	07 38	20 01	24	31

UT	ARIES	VENUS −4.0		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
29 00	186 03.3	211 44.1	S11 25.7	188 41.2	S 2 10.7	172 24.2	N 4 40.1	351 47.4	S 3 08.2
01	201 05.7	226 43.7	24.8	203 41.8	09.9	187 26.1	40.4	6 50.1	08.2
02	216 08.2	241 43.2	23.8	218 42.5	09.2	202 28.0	40.6	21 52.7	08.1
03	231 10.7	256 42.8 . .	22.8	233 43.2 . .	08.4	217 29.9 . .	40.8	36 55.4 . .	08.0
04	246 13.1	271 42.4	21.9	248 43.9	07.6	232 31.8	41.1	51 58.0	07.9
05	261 15.6	286 41.9	20.9	263 44.5	06.8	247 33.7	41.3	67 00.6	07.9
06	276 18.1	301 41.5	S11 19.9	278 45.2	S 2 06.0	262 35.6	N 4 41.5	82 03.3	S 3 07.8
07	291 20.5	316 41.0	18.9	293 45.9	05.2	277 37.5	41.8	97 05.9	07.7
08	306 23.0	331 40.6	18.0	308 46.6	04.4	292 39.5	42.0	112 08.6	07.6
T 09	321 25.5	346 40.2 . .	17.0	323 47.2 . .	03.6	307 41.4 . .	42.2	127 11.2 . .	07.6
U 10	336 27.9	1 39.7	16.0	338 47.9	02.9	322 43.3	42.5	142 13.9	07.5
E 11	351 30.4	16 39.3	15.1	353 48.6	02.1	337 45.2	42.7	157 16.5	07.4
S 12	6 32.8	31 38.9	S11 14.1	8 49.3	S 2 01.3	352 47.1	N 4 43.0	172 19.1	S 3 07.3
D 13	21 35.3	46 38.4	13.1	23 49.9	2 00.5	7 49.0	43.2	187 21.8	07.3
A 14	36 37.8	61 38.0	12.1	38 50.6	1 59.7	22 50.9	43.4	202 24.4	07.2
Y 15	51 40.2	76 37.6 . .	11.2	53 51.3 . .	58.9	37 52.8 . .	43.7	217 27.1 . .	07.1
16	66 42.7	91 37.1	10.2	68 52.0	58.1	52 54.7	43.9	232 29.7	07.0
17	81 45.2	106 36.7	09.2	83 52.7	57.3	67 56.6	44.1	247 32.3	06.9
18	96 47.6	121 36.3	S11 08.2	98 53.3	S 1 56.5	82 58.5	N 4 44.4	262 35.0	S 3 06.9
19	111 50.1	136 35.8	07.3	113 54.0	55.8	98 00.4	44.6	277 37.6	06.8
20	126 52.6	151 35.4	06.3	128 54.7	55.0	113 02.3	44.8	292 40.3	06.7
21	141 55.0	166 34.9 . .	05.3	143 55.4 . .	54.2	128 04.2 . .	45.1	307 42.9 . .	06.6
22	156 57.5	181 34.5	04.3	158 56.0	53.4	143 06.1	45.3	322 45.5	06.6
23	172 00.0	196 34.1	03.4	173 56.7	52.6	158 08.0	45.5	337 48.2	06.5
30 00	187 02.4	211 33.6	S11 02.4	188 57.4	S 1 51.8	173 09.9	N 4 45.8	352 50.8	S 3 06.4
01	202 04.9	226 33.2	01.4	203 58.1	51.0	188 11.9	46.0	7 53.5	06.3
02	217 07.3	241 32.8	11 00.4	218 58.7	50.2	203 13.8	46.2	22 56.1	06.3
03	232 09.8	256 32.4	10 59.4	233 59.4 . .	49.4	218 15.7 . .	46.5	37 58.8 . .	06.2
04	247 12.3	271 31.9	58.5	249 00.1	48.6	233 17.6	46.7	53 01.4	06.1
05	262 14.7	286 31.5	57.5	264 00.8	47.9	248 19.5	46.9	68 04.0	06.0
06	277 17.2	301 31.1	S10 56.5	279 01.5	S 1 47.1	263 21.4	N 4 47.2	83 06.7	S 3 06.0
W 07	292 19.7	316 30.6	55.5	294 02.1	46.3	278 23.3	47.4	98 09.3	05.9
E 08	307 22.1	331 30.2	54.5	309 02.8	45.5	293 25.2	47.6	113 12.0	05.8
D 09	322 24.6	346 29.8 . .	53.5	324 03.5 . .	44.7	308 27.1 . .	47.9	128 14.6 . .	05.7
N 10	337 27.1	1 29.3	52.6	339 04.2	43.9	323 29.0	48.1	143 17.2	05.6
E 11	352 29.5	16 28.9	51.6	354 04.8	43.1	338 30.9	48.3	158 19.9	05.6
S 12	7 32.0	31 28.5	S10 50.6	9 05.5	S 1 42.3	353 32.8	N 4 48.6	173 22.5	S 3 05.5
D 13	22 34.4	46 28.0	49.6	24 06.2	41.5	8 34.7	48.8	188 25.2	05.4
A 14	37 36.9	61 27.6	48.6	39 06.9	40.8	23 36.6	49.0	203 27.8	05.3
Y 15	52 39.4	76 27.2 . .	47.6	54 07.6 . .	40.0	38 38.5 . .	49.3	218 30.5 . .	05.3
16	67 41.8	91 26.8	46.6	69 08.2	39.2	53 40.4	49.5	233 33.1	05.2
17	82 44.3	106 26.3	45.6	84 08.9	38.4	68 42.3	49.7	248 35.7	05.1
18	97 46.8	121 25.9	S10 44.7	99 09.6	S 1 37.6	83 44.2	N 4 50.0	263 38.4	S 3 05.0
19	112 49.2	136 25.5	43.7	114 10.3	36.8	98 46.2	50.2	278 41.0	05.0
20	127 51.7	151 25.1	42.7	129 10.9	36.0	113 48.1	50.4	293 43.7	04.9
21	142 54.2	166 24.6 . .	41.7	144 11.6 . .	35.2	128 50.0 . .	50.7	308 46.3 . .	04.8
22	157 56.6	181 24.2	40.7	159 12.3	34.4	143 51.9	50.9	323 49.0	04.7
23	172 59.1	196 23.8	39.7	174 13.0	33.7	158 53.8	51.2	338 51.6	04.7
31 00	188 01.6	211 23.3	S10 38.7	189 13.7	S 1 32.9	173 55.7	N 4 51.4	353 54.2	S 3 04.6
01	203 04.0	226 22.9	37.7	204 14.3	32.1	188 57.6	51.6	8 56.9	04.5
02	218 06.5	241 22.5	36.7	219 15.0	31.3	203 59.5	51.9	23 59.5	04.4
03	233 08.9	256 22.1 . .	35.7	234 15.7 . .	30.5	219 01.4 . .	52.1	39 02.2 . .	04.3
04	248 11.4	271 21.6	34.7	249 16.4	29.7	234 03.3	52.3	54 04.8	04.3
05	263 13.9	286 21.2	33.7	264 17.0	28.9	249 05.2	52.6	69 07.4	04.2
06	278 16.3	301 20.8	S10 32.8	279 17.7	S 1 28.1	264 07.1	N 4 52.8	84 10.1	S 3 04.1
07	293 18.8	316 20.4	31.8	294 18.4	27.3	279 09.0	53.0	99 12.7	04.0
T 08	308 21.3	331 20.0	30.8	309 19.1	26.6	294 10.9	53.3	114 15.4	04.0
H 09	323 23.7	346 19.5 . .	29.8	324 19.8 . .	25.8	309 12.8 . .	53.5	129 18.0 . .	03.9
U 10	338 26.2	1 19.1	28.8	339 20.4	25.0	324 14.7	53.7	144 20.7	03.8
R 11	353 28.7	16 18.7	27.8	354 21.1	24.2	339 16.6	54.0	159 23.3	03.7
S 12	8 31.1	31 18.3	S10 26.8	9 21.8	S 1 23.4	354 18.5	N 4 54.2	174 25.9	S 3 03.7
D 13	23 33.6	46 17.8	25.8	24 22.5	22.6	9 20.4	54.4	189 28.6	03.6
A 14	38 36.1	61 17.4	24.8	39 23.2	21.8	24 22.4	54.7	204 31.2	03.5
Y 15	53 38.5	76 17.0 . .	23.8	54 23.8 . .	21.0	39 24.3 . .	54.9	219 33.9 . .	03.4
16	68 41.0	91 16.6	22.8	69 24.5	20.2	54 26.2	55.1	234 36.5	03.4
17	83 43.4	106 16.2	21.8	84 25.2	19.5	69 28.1	55.4	249 39.2	03.3
18	98 45.9	121 15.7	S10 20.8	99 25.9	S 1 18.7	84 30.0	N 4 55.6	264 41.8	S 3 03.2
19	113 48.4	136 15.3	19.8	114 26.6	17.9	99 31.9	55.8	279 44.4	03.1
20	128 50.8	151 14.9	18.8	129 27.2	17.1	114 33.8	56.1	294 47.1	03.0
21	143 53.3	166 14.5 . .	17.8	144 27.9 . .	16.3	129 35.7 . .	56.3	309 49.7 . .	03.0
22	158 55.8	181 14.1	16.8	159 28.6	15.5	144 37.6	56.5	324 52.4	02.9
23	173 58.2	196 13.6	15.8	174 29.3	14.7	159 39.5	56.8	339 55.0	02.8
Mer. Pass.	h m 11 29.9	v −0.4	d 1.0	v 0.7	d 0.8	v 1.9	d 0.2	v 2.6	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.7
Achernar	335 28.4	S57 10.8
Acrux	173 10.5	S63 09.9
Adhara	255 13.7	S28 59.6
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.4	N55 53.7
Alkaid	152 59.6	N49 15.2
Al Na'ir	27 46.0	S46 54.2
Alnilam	275 48.1	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.1	N26 40.4
Alpheratz	357 45.5	N29 09.1
Altair	62 09.9	N 8 53.8
Ankaa	353 17.6	S42 14.7
Antares	112 28.0	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 31.1	S69 02.6
Avior	234 18.5	S59 33.1
Bellatrix	278 33.8	N 6 21.5
Betelgeuse	271 03.1	N 7 24.4
Canopus	263 56.9	S52 42.5
Capella	280 37.0	N46 00.6
Deneb	49 32.8	N45 19.0
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.5
Dubhe	193 52.9	N61 41.3
Elnath	278 14.7	N28 37.0
Eltanin	90 46.8	N51 28.9
Enif	33 48.9	N 9 55.5
Fomalhaut	15 26.0	S29 33.7
Gacrux	172 02.2	S57 10.8
Gienah	175 53.6	S17 36.5
Hadar	148 49.7	S60 25.7
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.9	S34 22.6
Kochab	137 18.8	N74 06.3
Markab	13 40.2	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.1	S36 25.6
Miaplacidus	221 39.6	S69 46.2
Mirfak	308 43.0	N49 54.2
Nunki	76 00.3	S26 16.9
Peacock	53 21.9	S56 41.7
Pollux	243 29.5	N27 59.9
Procyon	245 01.3	N 5 11.6
Rasalhague	96 07.8	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.7	S 8 11.5
Rigil Kent.	139 53.4	S60 52.9
Sabik	102 14.2	S15 44.4
Schedar	349 43.0	N56 36.0
Shaula	96 24.0	S37 06.6
Sirius	258 35.1	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.4	S43 29.0
Vega	80 40.0	N38 47.4
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	24 31.2	9 54
Mars	1 55.0	11 24
Jupiter	346 07.5	12 26
Saturn	165 48.4	0 29

UT	SUN			MOON						Lat.	Twilight		Sunrise	Moonrise			
	GHA		Dec	GHA	v		Dec	d	HP		Naut.	Civil		29	30	31	1
d h	° ′		° ′	° ′	′		° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
29 00	178 44.9	N	3 09.4	237 52.2	13.4	S	15 31.5	9.6	55.0	N 72	02 04	03 56	05 09	05 54	05 21	04 58	04 39
01	193 45.1		10.4	252 24.6	13.6		15 21.9	9.5	54.9	N 70	02 39	04 10	05 15	05 24	05 05	04 50	04 37
02	208 45.3		11.3	266 57.2	13.6		15 12.4	9.7	54.9	68	03 03	04 21	05 19	05 01	04 51	04 43	04 35
03	223 45.5	. .	12.3	281 29.8	13.6		15 02.7	9.7	54.9	66	03 21	04 30	05 24	04 44	04 40	04 37	04 34
04	238 45.7		13.3	296 02.4	13.8		14 53.0	9.7	54.9	64	03 36	04 38	05 27	04 29	04 31	04 32	04 32
05	253 45.8		14.3	310 35.2	13.8		14 43.3	9.8	54.9	62	03 48	04 45	05 30	04 17	04 23	04 28	04 31
06	268 46.0	N	3 15.2	325 08.0	13.8	S	14 33.5	9.9	54.8	60	03 58	04 50	05 33	04 06	04 16	04 24	04 31
07	283 46.2		16.2	339 40.8	13.9		14 23.6	9.9	54.8	N 58	04 06	04 55	05 35	03 57	04 10	04 20	04 30
T 08	298 46.4		17.2	354 13.7	14.0		14 13.7	10.0	54.8	56	04 14	04 59	05 37	03 49	04 05	04 17	04 29
U 09	313 46.6	. .	18.2	8 46.7	14.0		14 03.7	10.0	54.8	54	04 20	05 03	05 39	03 42	04 00	04 15	04 28
E 10	328 46.8		19.1	23 19.7	14.1		13 53.7	10.0	54.8	52	04 25	05 06	05 41	03 36	03 55	04 12	04 28
S 11	343 47.0		20.1	37 52.8	14.2		13 43.7	10.2	54.7	50	04 30	05 09	05 42	03 30	03 51	04 10	04 27
D 12	358 47.2	N	3 21.1	52 26.0	14.2	S	13 33.5	10.1	54.7	45	04 41	05 16	05 45	03 17	03 42	04 05	04 26
A 13	13 47.3		22.1	66 59.2	14.3		13 23.4	10.3	54.7	N 40	04 49	05 21	05 48	03 07	03 35	04 01	04 25
Y 14	28 47.5		23.0	81 32.5	14.3		13 13.1	10.2	54.7	35	04 55	05 25	05 50	02 58	03 29	03 57	04 24
15	43 47.7	. .	24.0	96 05.8	14.4		13 02.9	10.4	54.7	30	05 00	05 28	05 52	02 50	03 23	03 54	04 23
16	58 47.9		25.0	110 39.2	14.5		12 52.5	10.3	54.7	20	05 08	05 34	05 56	02 36	03 14	03 48	04 22
17	73 48.1		26.0	125 12.7	14.5		12 42.2	10.5	54.6	N 10	05 13	05 38	05 59	02 24	03 05	03 44	04 21
18	88 48.3	N	3 26.9	139 46.2	14.6	S	12 31.7	10.4	54.6	0	05 17	05 41	06 01	02 13	02 57	03 39	04 20
19	103 48.5		27.9	154 19.8	14.6		12 21.3	10.5	54.6	S 10	05 18	05 43	06 04	02 02	02 49	03 34	04 19
20	118 48.7		28.9	168 53.4	14.6		12 10.8	10.6	54.6	20	05 19	05 44	06 06	01 50	02 40	03 29	04 17
21	133 48.9	. .	29.9	183 27.0	14.8		12 00.2	10.6	54.6	30	05 18	05 45	06 09	01 36	02 30	03 24	04 16
22	148 49.0		30.8	198 00.8	14.7		11 49.6	10.6	54.6	35	05 16	05 46	06 11	01 28	02 25	03 21	04 15
23	163 49.2		31.8	212 34.5	14.8		11 39.0	10.7	54.5	40	05 14	05 46	06 13	01 18	02 18	03 17	04 15
30 00	178 49.4	N	3 32.8	227 08.3	14.9	S	11 28.3	10.7	54.5	45	05 11	05 45	06 15	01 07	02 11	03 13	04 14
01	193 49.6		33.7	241 42.2	14.9		11 17.6	10.8	54.5	S 50	05 07	05 45	06 17	00 54	02 01	03 07	04 12
02	208 49.8		34.7	256 16.1	15.0		11 06.8	10.8	54.5	52	05 05	05 44	06 18	00 48	01 57	03 05	04 12
03	223 50.0	. .	35.7	270 50.1	15.0		10 56.0	10.8	54.5	54	05 03	05 44	06 19	00 41	01 53	03 02	04 11
04	238 50.2		36.7	285 24.1	15.1		10 45.2	10.9	54.5	56	05 00	05 43	06 20	00 34	01 47	03 00	04 11
05	253 50.3		37.6	299 58.2	15.1		10 34.3	10.9	54.4	58	04 57	05 43	06 22	00 25	01 41	02 56	04 10
06	268 50.5	N	3 38.6	314 32.3	15.2	S	10 23.4	10.9	54.4	S 60	04 53	05 42	06 23	00 15	01 35	02 53	04 09
W 07	283 50.7		39.6	329 06.5	15.2		10 12.5	11.0	54.4	Lat.	Sunset	Twilight		Moonset			
E 08	298 50.9		40.6	343 40.7	15.2		10 01.5	11.0	54.4			Civil	Naut.	29	30	31	1
D 09	313 51.1	. .	41.5	358 14.9	15.3		9 50.5	11.1	54.4								
N 10	328 51.3		42.5	12 49.2	15.3		9 39.4	11.1	54.4	°	h m	h m	h m	h m	h m	h m	h m
E 11	343 51.5		43.5	27 23.5	15.4		9 28.3	11.1	54.4	N 72	19 03	20 17	22 13	11 13	13 15	15 05	16 51
S 12	358 51.7	N	3 44.4	41 57.9	15.4	S	9 17.2	11.1	54.3	N 70	18 57	20 02	21 36	11 41	13 30	15 11	16 49
D 13	13 51.8		45.4	56 32.3	15.4		9 06.1	11.2	54.3	68	18 52	19 51	21 10	12 03	13 42	15 16	16 48
A 14	28 52.0		46.4	71 06.7	15.5		8 54.9	11.2	54.3	66	18 48	19 41	20 51	12 19	13 52	15 20	16 48
Y 15	43 52.2	. .	47.4	85 41.2	15.6		8 43.7	11.3	54.3	64	18 44	19 33	20 36	12 33	14 00	15 24	16 47
16	58 52.4		48.3	100 15.8	15.5		8 32.4	11.3	54.3	62	18 41	19 26	20 24	12 44	14 06	15 27	16 46
17	73 52.6		49.3	114 50.3	15.6		8 21.1	11.3	54.3	60	18 38	19 21	20 14	12 53	14 12	15 30	16 46
18	88 52.8	N	3 50.3	129 24.9	15.7	S	8 09.8	11.3	54.3	N 58	18 36	19 16	20 05	13 02	14 18	15 32	16 45
19	103 53.0		51.2	143 59.6	15.6		7 58.5	11.3	54.3	56	18 33	19 11	19 57	13 09	14 22	15 34	16 45
20	118 53.2		52.2	158 34.2	15.8		7 47.2	11.4	54.3	54	18 31	19 07	19 51	13 16	14 26	15 36	16 44
21	133 53.3	. .	53.2	173 09.0	15.7		7 35.8	11.4	54.2	52	18 30	19 04	19 45	13 21	14 30	15 37	16 44
22	148 53.5		54.2	187 43.7	15.8		7 24.4	11.4	54.2	50	18 28	19 01	19 40	13 27	14 33	15 39	16 44
23	163 53.7		55.1	202 18.5	15.8		7 13.0	11.5	54.2	45	18 25	18 54	19 29	13 38	14 41	15 42	16 43
31 00	178 53.9	N	3 56.1	216 53.3	15.8	S	7 01.5	11.5	54.2	N 40	18 22	18 49	19 21	13 47	14 47	15 45	16 42
01	193 54.1		57.1	231 28.1	15.9		6 50.0	11.5	54.2	35	18 19	18 45	19 15	13 55	14 52	15 47	16 42
02	208 54.3		58.0	246 03.0	15.9		6 38.5	11.5	54.2	30	18 17	18 41	19 09	14 02	14 56	15 49	16 41
03	223 54.5	3	59.0	260 37.9	15.9		6 27.0	11.5	54.2	20	18 14	18 36	19 02	14 14	15 04	15 53	16 41
04	238 54.6	4	00.0	275 12.8	15.9		6 15.5	11.6	54.2	N 10	18 11	18 32	18 56	14 25	15 11	15 56	16 40
05	253 54.8		00.9	289 47.7	16.0		6 03.9	11.6	54.2	0	18 08	18 29	18 53	14 34	15 17	15 59	16 39
06	268 55.0	N	4 01.9	304 22.7	16.0	S	5 52.3	11.6	54.1	S 10	18 05	18 26	18 51	14 44	15 24	16 02	16 39
07	283 55.2		02.9	318 57.7	16.1		5 40.7	11.6	54.1	20	18 02	18 24	18 50	14 54	15 30	16 05	16 38
T 08	298 55.4		03.8	333 32.8	16.0		5 29.1	11.6	54.1	30	17 59	18 23	18 51	15 06	15 38	16 08	16 37
H 09	313 55.6	. .	04.8	348 07.8	16.1		5 17.5	11.7	54.1	35	17 58	18 23	18 52	15 13	15 42	16 10	16 37
U 10	328 55.8		05.8	2 42.9	16.1		5 05.8	11.7	54.1	40	17 56	18 23	18 54	15 20	15 47	16 12	16 36
R 11	343 56.0		06.8	17 18.0	16.1		4 54.1	11.6	54.1	45	17 54	18 23	18 57	15 29	15 53	16 15	16 35
S 12	358 56.1	N	4 07.7	31 53.1	16.2	S	4 42.5	11.7	54.1	S 50	17 51	18 24	19 01	15 40	16 00	16 18	16 35
D 13	13 56.3		08.7	46 28.3	16.1		4 30.8	11.8	54.1	52	17 50	18 24	19 03	15 45	16 03	16 19	16 34
A 14	28 56.5		09.7	61 03.4	16.2		4 19.0	11.7	54.1	54	17 49	18 24	19 05	15 50	16 06	16 20	16 34
Y 15	43 56.7	. .	10.6	75 38.6	16.2		4 07.3	11.7	54.1	56	17 48	18 25	19 08	15 56	16 10	16 22	16 33
16	58 56.9		11.6	90 13.8	16.2		3 55.6	11.8	54.1	58	17 46	18 25	19 11	16 02	16 14	16 24	16 33
17	73 57.1		12.6	104 49.0	16.3		3 43.8	11.7	54.1	S 60	17 45	18 26	19 14	16 10	16 19	16 26	16 32
18	88 57.3	N	4 13.5	119 24.3	16.2	S	3 32.1	11.8	54.1		SUN			MOON			
19	103 57.4		14.5	133 59.5	16.3		3 20.3	11.8	54.0	Day	Eqn. of Time		Mer.	Mer. Pass.		Age	Phase
20	118 57.6		15.5	148 34.8	16.3		3 08.5	11.8	54.0		00^h	12^h	Pass.	Upper	Lower		
21	133 57.8	. .	16.4	163 10.1	16.2		2 56.7	11.8	54.0	d	m s	m s	h m	h m	h m	d	%
22	148 58.0		17.4	177 45.3	16.4		2 44.9	11.8	54.0	29	05 01	04 52	12 05	08 24	20 46	25	22
23	163 58.2		18.4	192 20.7	16.3	S	2 33.1	11.8	54.0	30	04 43	04 34	12 05	09 07	21 28	26	15
	SD 16.0	d	1.0	SD	14.9		14.8		14.7	31	04 25	04 16	12 04	09 49	22 09	27	9

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1 00	189 00.7	211 13.2	S10 14.7	189 30.0	S 1 13.9	174 41.4	N 4 57.0	354 57.7	S 3 02.7
01	204 03.2	226 12.8	13.7	204 30.6	13.1	189 43.3	57.2	10 00.3	02.7
02	219 05.6	241 12.4	12.7	219 31.3	12.4	204 45.2	57.5	25 02.9	02.6
03	234 08.1	256 12.0	11.7	234 32.0	11.6	219 47.1	57.7	40 05.6	02.5
04	249 10.5	271 11.5	10.7	249 32.7	10.8	234 49.0	57.9	55 08.2	02.4
05	264 13.0	286 11.1	09.7	264 33.4	10.0	249 50.9	58.2	70 10.9	02.4
06	279 15.5	301 10.7	S10 08.7	279 34.0	S 1 09.2	264 52.8	N 4 58.4	85 13.5	S 3 02.3
07	294 17.9	316 10.3	07.7	294 34.7	08.4	279 54.7	58.6	100 16.2	02.2
08	309 20.4	331 09.9	06.7	309 35.4	07.6	294 56.6	58.9	115 18.8	02.1
F 09	324 22.9	346 09.5	05.7	324 36.1	06.8	309 58.5	59.1	130 21.4	02.1
R 10	339 25.3	1 09.1	04.7	339 36.8	06.0	325 00.4	59.3	145 24.1	02.0
I 11	354 27.8	16 08.6	03.7	354 37.4	05.3	340 02.4	59.6	160 26.7	01.9
D 12	9 30.3	31 08.2	S10 02.7	9 38.1	S 1 04.5	355 04.3	N 4 59.8	175 29.4	S 3 01.8
A 13	24 32.7	46 07.8	01.6	24 38.8	03.7	10 06.2	5 00.0	190 32.0	01.7
Y 14	39 35.2	61 07.4	10 00.6	39 39.5	02.9	25 08.1	00.3	205 34.6	01.7
15	54 37.7	76 07.0	9 59.6	54 40.2	02.1	40 10.0	00.5	220 37.3	01.6
16	69 40.1	91 06.6	58.6	69 40.8	01.3	55 11.9	00.7	235 39.9	01.5
17	84 42.6	106 06.1	57.6	84 41.5	1 00.5	70 13.8	01.0	250 42.6	01.4
18	99 45.0	121 05.7	S 9 56.6	99 42.2	S 0 59.7	85 15.7	N 5 01.2	265 45.2	S 3 01.4
19	114 47.5	136 05.3	55.6	114 42.9	58.9	100 17.6	01.4	280 47.9	01.3
20	129 50.0	151 04.9	54.6	129 43.6	58.2	115 19.5	01.7	295 50.5	01.2
21	144 52.4	166 04.5	53.5	144 44.2	57.4	130 21.4	01.9	310 53.1	01.1
22	159 54.9	181 04.1	52.5	159 44.9	56.6	145 23.3	02.1	325 55.8	01.1
23	174 57.4	196 03.7	51.5	174 45.6	55.8	160 25.2	02.4	340 58.4	01.0
2 00	189 59.8	211 03.3	S 9 50.5	189 46.3	S 0 55.0	175 27.1	N 5 02.6	356 01.1	S 3 00.9
01	205 02.3	226 02.8	49.5	204 47.0	54.2	190 29.0	02.8	11 03.7	00.8
02	220 04.8	241 02.4	48.5	219 47.7	53.4	205 30.9	03.1	26 06.4	00.8
03	235 07.2	256 02.0	47.4	234 48.3	52.6	220 32.8	03.3	41 09.0	00.7
04	250 09.7	271 01.6	46.4	249 49.0	51.8	235 34.7	03.5	56 11.6	00.6
05	265 12.1	286 01.2	45.4	264 49.7	51.1	250 36.6	03.8	71 14.3	00.5
06	280 14.6	301 00.8	S 9 44.4	279 50.4	S 0 50.3	265 38.5	N 5 04.0	86 16.9	S 3 00.4
07	295 17.1	316 00.4	43.4	294 51.1	49.5	280 40.4	04.2	101 19.6	00.4
S 08	310 19.5	331 00.0	42.3	309 51.7	48.7	295 42.3	04.5	116 22.2	00.3
A 09	325 22.0	345 59.6	41.3	324 52.4	47.9	310 44.2	04.7	131 24.9	00.2
T 10	340 24.5	0 59.2	40.3	339 53.1	47.1	325 46.2	05.0	146 27.5	00.1
U 11	355 26.9	15 58.8	39.3	354 53.8	46.3	340 48.1	05.2	161 30.2	00.1
R 12	10 29.4	30 58.3	S 9 38.3	9 54.5	S 0 45.5	355 50.0	N 5 05.4	176 32.8	S 3 00.0
D 13	25 31.9	45 57.9	37.2	24 55.1	44.8	10 51.9	05.7	191 35.4	2 59.9
A 14	40 34.3	60 57.5	36.2	39 55.8	44.0	25 53.8	05.9	206 38.1	59.8
Y 15	55 36.8	75 57.1	35.2	54 56.5	43.2	40 55.7	06.1	221 40.7	59.8
16	70 39.3	90 56.7	34.2	69 57.2	42.4	55 57.6	06.4	236 43.4	59.7
17	85 41.7	105 56.3	33.1	84 57.9	41.6	70 59.5	06.6	251 46.0	59.6
18	100 44.2	120 55.9	S 9 32.1	99 58.6	S 0 40.8	86 01.4	N 5 06.8	266 48.7	S 2 59.5
19	115 46.6	135 55.5	31.1	114 59.2	40.0	101 03.3	07.1	281 51.3	59.5
20	130 49.1	150 55.1	30.1	129 59.9	39.2	116 05.2	07.3	296 53.9	59.4
21	145 51.6	165 54.7	29.0	145 00.6	38.4	131 07.1	07.5	311 56.6	59.3
22	160 54.0	180 54.3	28.0	160 01.3	37.7	146 09.0	07.8	326 59.2	59.2
23	175 56.5	195 53.9	27.0	175 02.0	36.9	161 10.9	08.0	342 01.9	59.2
3 00	190 59.0	210 53.5	S 9 26.0	190 02.7	S 0 36.1	176 12.8	N 5 08.2	357 04.5	S 2 59.1
01	206 01.4	225 53.1	24.9	205 03.3	35.3	191 14.7	08.5	12 07.2	59.0
02	221 03.9	240 52.7	23.9	220 04.0	34.5	206 16.6	08.7	27 09.8	58.9
03	236 06.4	255 52.3	22.9	235 04.7	33.7	221 18.5	08.9	42 12.4	58.8
04	251 08.8	270 51.8	21.8	250 05.4	32.9	236 20.4	09.2	57 15.1	58.8
05	266 11.3	285 51.4	20.8	265 06.1	32.1	251 22.3	09.4	72 17.7	58.7
06	281 13.7	300 51.0	S 9 19.8	280 06.8	S 0 31.4	266 24.2	N 5 09.6	87 20.4	S 2 58.6
07	296 16.2	315 50.6	18.7	295 07.4	30.6	281 26.1	09.9	102 23.0	58.5
08	311 18.7	330 50.2	17.7	310 08.1	29.8	296 28.0	10.1	117 25.7	58.5
S 09	326 21.1	345 49.8	16.7	325 08.8	29.0	311 29.9	10.3	132 28.3	58.4
U 10	341 23.6	0 49.4	15.7	340 09.5	28.2	326 31.8	10.6	147 30.9	58.3
N 11	356 26.1	15 49.0	14.6	355 10.2	27.4	341 33.7	10.8	162 33.6	58.2
D 12	11 28.5	30 48.6	S 9 13.6	10 10.8	S 0 26.6	356 35.7	N 5 11.0	177 36.2	S 2 58.2
A 13	26 31.0	45 48.2	12.5	25 11.5	25.8	11 37.6	11.3	192 38.9	58.1
Y 14	41 33.5	60 47.8	11.5	40 12.2	25.0	26 39.5	11.5	207 41.5	58.0
15	56 35.9	75 47.4	10.5	55 12.9	24.3	41 41.4	11.7	222 44.2	57.9
16	71 38.4	90 47.0	09.4	70 13.6	23.5	56 43.3	12.0	237 46.8	57.9
17	86 40.9	105 46.6	08.4	85 14.3	22.7	71 45.2	12.2	252 49.4	57.8
18	101 43.3	120 46.2	S 9 07.4	100 14.9	S 0 21.9	86 47.1	N 5 12.4	267 52.1	S 2 57.7
19	116 45.8	135 45.8	06.3	115 15.6	21.1	101 49.0	12.7	282 54.7	57.6
20	131 48.2	150 45.4	05.3	130 16.3	20.3	116 50.9	12.9	297 57.4	57.6
21	146 50.7	165 45.0	04.3	145 17.0	19.5	131 52.8	13.1	313 00.0	57.5
22	161 53.2	180 44.6	03.2	160 17.7	18.7	146 54.7	13.4	328 02.7	57.4
23	176 55.6	195 44.2	02.2	175 18.4	18.0	161 56.6	13.6	343 05.3	57.3
	h m								
Mer. Pass.	11 18.2	*v* −0.4	*d* 1.0	*v* 0.7	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.7
Achernar	335 28.4	S57 10.8
Acrux	173 10.5	S63 09.9
Adhara	255 13.8	S28 59.6
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.4	N55 53.7
Alkaid	152 59.6	N49 15.2
Al Na'ir	27 46.0	S46 54.2
Alnilam	275 48.1	S 1 11.9
Alphard	217 57.4	S 8 42.7
Alphecca	126 12.1	N26 40.4
Alpheratz	357 45.5	N29 09.1
Altair	62 09.9	N 8 53.8
Ankaa	353 17.6	S42 14.7
Antares	112 28.0	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 31.1	S69 02.6
Avior	234 18.5	S59 33.1
Bellatrix	278 33.8	N 6 21.5
Betelgeuse	271 03.1	N 7 24.4
Canopus	263 56.9	S52 42.5
Capella	280 37.0	N46 00.6
Deneb	49 32.8	N45 19.0
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.5
Dubhe	193 52.9	N61 41.4
Elnath	278 14.8	N28 37.0
Eltanin	90 46.7	N51 28.9
Enif	33 48.9	N 9 55.5
Fomalhaut	15 26.0	S29 33.7
Gacrux	172 02.2	S57 10.8
Gienah	175 53.6	S17 36.5
Hadar	148 49.6	S60 25.7
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.9	S34 22.6
Kochab	137 18.8	N74 06.3
Markab	13 40.2	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.1	S36 25.6
Miaplacidus	221 39.6	S69 46.2
Mirfak	308 43.1	N49 54.2
Nunki	76 00.3	S26 16.9
Peacock	53 21.9	S56 41.7
Pollux	243 29.6	N27 59.9
Procyon	245 01.3	N 5 11.6
Rasalhague	96 07.8	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.7	S 8 11.5
Rigil Kent.	139 53.4	S60 52.9
Sabik	102 14.2	S15 44.4
Schedar	349 43.0	N56 36.0
Shaula	96 23.9	S37 06.6
Sirius	258 35.1	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.4	S43 29.1
Vega	80 40.0	N38 47.4
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	21 03.4	9 56
Mars	359 46.5	11 20
Jupiter	345 27.3	12 17
Saturn	166 01.3	0 16

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
1 00	178 58.4	N 4 19.3	206 56.0	16.3	S 2 21.3	11.9	54.0
01	193 58.6	20.3	221 31.3	16.3	2 09.4	11.8	54.0
02	208 58.7	21.3	236 06.6	16.4	1 57.6	11.8	54.0
03	223 58.9	. . 22.2	250 42.0	16.4	1 45.8	11.9	54.0
04	238 59.1	23.2	265 17.4	16.3	1 33.9	11.8	54.0
05	253 59.3	24.2	279 52.7	16.4	1 22.1	11.9	54.0
06	268 59.5	N 4 25.1	294 28.1	16.4	S 1 10.2	11.8	54.0
07	283 59.7	26.1	309 03.5	16.4	0 58.4	11.9	54.0
08	298 59.9	27.1	323 38.9	16.4	0 46.5	11.8	54.0
F 09	314 00.0	. . 28.0	338 14.3	16.4	0 34.7	11.9	54.0
R 10	329 00.2	29.0	352 49.7	16.4	0 22.8	11.9	54.0
I 11	344 00.4	30.0	7 25.1	16.4	S 0 10.9	11.8	54.0
D 12	359 00.6	N 4 30.9	22 00.5	16.4	N 0 00.9	11.9	54.0
A 13	14 00.8	31.9	36 35.9	16.4	0 12.8	11.8	54.0
Y 14	29 01.0	32.9	51 11.3	16.4	0 24.6	11.9	54.0
15	44 01.1	. . 33.8	65 46.7	16.4	0 36.5	11.8	53.9
16	59 01.3	34.8	80 22.1	16.4	0 48.3	11.9	53.9
17	74 01.5	35.8	94 57.5	16.4	1 00.2	11.8	53.9
18	89 01.7	N 4 36.7	109 32.9	16.4	N 1 12.0	11.8	53.9
19	104 01.9	37.7	124 08.3	16.4	1 23.8	11.9	53.9
20	119 02.1	38.7	138 43.7	16.4	1 35.7	11.8	53.9
21	134 02.3	. . 39.6	153 19.1	16.3	1 47.5	11.8	53.9
22	149 02.4	40.6	167 54.4	16.4	1 59.3	11.8	53.9
23	164 02.6	41.5	182 29.8	16.4	2 11.1	11.8	53.9
2 00	179 02.8	N 4 42.5	197 05.2	16.3	N 2 22.9	11.8	53.9
01	194 03.0	43.5	211 40.5	16.4	2 34.7	11.8	53.9
02	209 03.2	44.4	226 15.9	16.3	2 46.5	11.8	53.9
03	224 03.4	. . 45.4	240 51.2	16.4	2 58.3	11.7	53.9
04	239 03.5	46.4	255 26.6	16.3	3 10.0	11.8	53.9
05	254 03.7	47.3	270 01.9	16.3	3 21.8	11.7	53.9
06	269 03.9	N 4 48.3	284 37.2	16.3	N 3 33.5	11.7	53.9
07	284 04.1	49.3	299 12.5	16.3	3 45.2	11.7	53.9
S 08	299 04.3	50.2	313 47.8	16.3	3 56.9	11.7	53.9
A 09	314 04.5	. . 51.2	328 23.1	16.2	4 08.6	11.7	53.9
T 10	329 04.7	52.1	342 58.3	16.3	4 20.3	11.6	53.9
U 11	344 04.8	53.1	357 33.6	16.2	4 31.9	11.7	53.9
R 12	359 05.0	N 4 54.1	12 08.8	16.2	N 4 43.6	11.6	53.9
D 13	14 05.2	55.0	26 44.0	16.2	4 55.2	11.6	53.9
A 14	29 05.4	56.0	41 19.2	16.1	5 06.8	11.6	53.9
Y 15	44 05.6	. . 56.9	55 54.3	16.2	5 18.4	11.6	53.9
16	59 05.8	57.9	70 29.5	16.1	5 30.0	11.5	53.9
17	74 05.9	58.9	85 04.6	16.1	5 41.5	11.5	53.9
18	89 06.1	N 4 59.8	99 39.7	16.1	N 5 53.0	11.5	53.9
19	104 06.3	5 00.8	114 14.8	16.1	6 04.5	11.5	53.9
20	119 06.5	01.8	128 49.9	16.1	6 16.0	11.5	53.9
21	134 06.7	. . 02.7	143 25.0	16.0	6 27.5	11.4	53.9
22	149 06.9	03.7	158 00.0	16.0	6 38.9	11.4	53.9
23	164 07.0	04.6	172 35.0	15.9	6 50.3	11.4	53.9
3 00	179 07.2	N 5 05.6	187 09.9	16.0	N 7 01.7	11.4	53.9
01	194 07.4	06.6	201 44.9	15.9	7 13.1	11.3	53.9
02	209 07.6	07.5	216 19.8	15.9	7 24.4	11.3	53.9
03	224 07.8	. . 08.5	230 54.7	15.9	7 35.7	11.3	53.9
04	239 08.0	09.4	245 29.6	15.8	7 47.0	11.2	53.9
05	254 08.1	10.4	260 04.4	15.8	7 58.2	11.3	54.0
06	269 08.3	N 5 11.4	274 39.2	15.8	N 8 09.5	11.2	54.0
07	284 08.5	12.3	289 14.0	15.8	8 20.7	11.1	54.0
08	299 08.7	13.3	303 48.8	15.7	8 31.8	11.1	54.0
S 09	314 08.9	. . 14.2	318 23.5	15.7	8 42.9	11.1	54.0
U 10	329 09.0	15.2	332 58.2	15.6	8 54.0	11.1	54.0
N 11	344 09.2	16.1	347 32.8	15.6	9 05.1	11.0	54.0
D 12	359 09.4	N 5 17.1	2 07.4	15.6	N 9 16.1	11.0	54.0
A 13	14 09.6	18.1	16 42.0	15.6	9 27.1	11.0	54.0
Y 14	29 09.8	19.0	31 16.6	15.5	9 38.1	10.9	54.0
15	44 10.0	. . 20.0	45 51.1	15.5	9 49.0	10.9	54.0
16	59 10.1	20.9	60 25.6	15.4	9 59.9	10.8	54.0
17	74 10.3	21.9	75 00.0	15.4	10 10.7	10.8	54.0
18	89 10.5	N 5 22.9	89 34.4	15.4	N10 21.5	10.8	54.0
19	104 10.7	23.8	104 08.8	15.3	10 32.3	10.7	54.0
20	119 10.9	24.8	118 43.1	15.3	10 43.0	10.7	54.0
21	134 11.1	. . 25.7	133 17.4	15.3	10 53.7	10.7	54.0
22	149 11.2	26.7	147 51.7	15.2	11 04.4	10.6	54.0
23	164 11.4	27.6	162 25.9	15.2	N11 15.0	10.5	54.0
	SD 16.0	d 1.0	SD	14.7		14.7	14.7

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		1	2	3	4
°	h m	h m	h m	h m	h m	h m	h m
N 72	01 30	03 37	04 53	04 39	04 20	04 00	03 35
N 70	02 16	03 54	05 00	04 37	04 24	04 11	03 56
68	02 45	04 07	05 07	04 35	04 28	04 20	04 11
66	03 06	04 18	05 12	04 34	04 30	04 27	04 24
64	03 23	04 27	05 16	04 32	04 33	04 34	04 35
62	03 36	04 34	05 20	04 31	04 35	04 39	04 45
60	03 47	04 41	05 24	04 31	04 37	04 44	04 53
N 58	03 56	04 46	05 27	04 30	04 39	04 49	05 00
56	04 05	04 51	05 29	04 29	04 40	04 52	05 06
54	04 12	04 55	05 31	04 28	04 42	04 56	05 12
52	04 18	04 59	05 34	04 28	04 43	04 59	05 17
50	04 23	05 03	05 36	04 27	04 44	05 02	05 21
45	04 35	05 10	05 40	04 26	04 47	05 08	05 31
N 40	04 44	05 16	05 43	04 25	04 49	05 13	05 40
35	04 51	05 21	05 46	04 24	04 51	05 18	05 47
30	04 57	05 25	05 49	04 23	04 52	05 22	05 53
20	05 05	05 31	05 53	04 22	04 55	05 29	06 04
N 10	05 11	05 36	05 57	04 21	04 58	05 35	06 14
0	05 16	05 40	06 00	04 20	05 00	05 41	06 23
S 10	05 18	05 43	06 04	04 19	05 03	05 47	06 33
20	05 20	05 45	06 07	04 17	05 05	05 54	06 43
30	05 19	05 47	06 11	04 16	05 08	06 01	06 54
35	05 19	05 48	06 13	04 15	05 10	06 05	07 01
40	05 17	05 49	06 16	04 15	05 12	06 10	07 08
45	05 15	05 49	06 18	04 14	05 14	06 15	07 17
S 50	05 12	05 49	06 22	04 12	05 17	06 22	07 28
52	05 10	05 49	06 23	04 12	05 19	06 25	07 33
54	05 08	05 49	06 25	04 11	05 20	06 29	07 38
56	05 06	05 49	06 26	04 11	05 22	06 33	07 45
58	05 04	05 49	06 28	04 10	05 23	06 37	07 52
S 60	05 01	05 49	06 31	04 09	05 25	06 42	07 59

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	1	2	3	4
°	h m	h m	h m	h m	h m	h m	h m
N 72	19 18	20 34	22 50	16 51	18 37	20 28	22 36
N 70	19 10	20 17	21 58	16 49	18 28	20 10	22 00
68	19 03	20 03	21 27	16 48	18 21	19 55	21 35
66	18 57	19 52	21 05	16 48	18 15	19 44	21 16
64	18 53	19 43	20 48	16 47	18 10	19 34	21 00
62	18 49	19 35	20 34	16 46	18 06	19 26	20 48
60	18 45	19 28	20 23	16 46	18 02	19 19	20 37
N 58	18 42	19 23	20 13	16 45	17 59	19 13	20 28
56	18 39	19 18	20 05	16 45	17 56	19 07	20 19
54	18 37	19 13	19 57	16 44	17 53	19 02	20 12
52	18 35	19 09	19 51	16 44	17 51	18 58	20 06
50	18 33	19 06	19 45	16 44	17 49	18 54	20 00
45	18 28	18 58	19 34	16 43	17 44	18 45	19 47
N 40	18 25	18 52	19 25	16 42	17 40	18 38	19 37
35	18 22	18 47	19 17	16 42	17 37	18 32	19 28
30	18 19	18 43	19 11	16 41	17 34	18 26	19 20
20	18 14	18 37	19 02	16 41	17 29	18 17	19 07
N 10	18 11	18 32	18 56	16 40	17 24	18 09	18 55
0	18 07	18 28	18 52	16 39	17 20	18 01	18 44
S 10	18 03	18 25	18 49	16 39	17 16	17 54	18 34
20	18 00	18 22	18 47	16 38	17 11	17 46	18 22
30	17 56	18 20	18 47	16 37	17 06	17 37	18 09
35	17 54	18 19	18 48	16 37	17 03	17 31	18 01
40	17 51	18 18	18 49	16 36	17 00	17 25	17 53
45	17 48	18 18	18 51	16 35	16 56	17 18	17 43
S 50	17 45	18 17	18 54	16 35	16 52	17 10	17 31
52	17 43	18 17	18 56	16 34	16 50	17 06	17 25
54	17 42	18 17	18 58	16 34	16 47	17 02	17 19
56	17 40	18 17	19 00	16 33	16 45	16 58	17 12
58	17 38	18 17	19 02	16 33	16 42	16 52	17 05
S 60	17 36	18 17	19 05	16 32	16 39	16 47	16 56

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00h	12h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
1	04 07	03 58	12 04	10 29	22 50	28	4
2	03 49	03 40	12 04	11 10	23 31	29	1
3	03 31	03 23	12 03	11 51	24 12	30	0

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
4 00	191 58.1	210 43.8	S 9 01.1	190 19.1	S 0 17.2	176 58.5	N 5 13.8	358 07.9	S 2 57.3
01	207 00.6	225 43.4	9 00.1	205 19.7	16.4	192 00.4	14.1	13 10.6	57.2
02	222 03.0	240 43.0	8 59.1	220 20.4	15.6	207 02.3	14.3	28 13.2	57.1
03	237 05.5	255 42.6	. . 58.0	235 21.1	. . 14.8	222 04.2	. . 14.5	43 15.9	. . 57.0
04	252 08.0	270 42.2	57.0	250 21.8	14.0	237 06.1	14.7	58 18.5	56.9
05	267 10.4	285 41.8	55.9	265 22.5	13.2	252 08.0	15.0	73 21.2	56.9
06	282 12.9	300 41.4	S 8 54.9	280 23.2	S 0 12.4	267 09.9	N 5 15.2	88 23.8	S 2 56.8
07	297 15.3	315 41.0	53.9	295 23.8	11.7	282 11.8	15.4	103 26.5	56.7
08	312 17.8	330 40.6	52.8	310 24.5	10.9	297 13.7	15.7	118 29.1	56.6
M 09	327 20.3	345 40.3	. . 51.8	325 25.2	. . 10.1	312 15.6	. . 15.9	133 31.7	. . 56.6
O 10	342 22.7	0 39.9	50.7	340 25.9	09.3	327 17.5	16.1	148 34.4	56.5
N 11	357 25.2	15 39.5	49.7	355 26.6	08.5	342 19.4	16.4	163 37.0	56.4
D 12	12 27.7	30 39.1	S 8 48.6	10 27.3	S 0 07.7	357 21.3	N 5 16.6	178 39.7	S 2 56.3
A 13	27 30.1	45 38.7	47.6	25 27.9	06.9	12 23.2	16.8	193 42.3	56.3
Y 14	42 32.6	60 38.3	46.6	40 28.6	06.1	27 25.1	17.1	208 45.0	56.2
15	57 35.1	75 37.9	. . 45.5	55 29.3	. . 05.4	42 27.1	. . 17.3	223 47.6	. . 56.1
16	72 37.5	90 37.5	44.5	70 30.0	04.6	57 29.0	17.5	238 50.2	56.0
17	87 40.0	105 37.1	43.4	85 30.7	03.8	72 30.9	17.8	253 52.9	56.0
18	102 42.5	120 36.7	S 8 42.4	100 31.4	S 0 03.0	87 32.8	N 5 18.0	268 55.5	S 2 55.9
19	117 44.9	135 36.3	41.3	115 32.1	02.2	102 34.7	18.2	283 58.2	55.8
20	132 47.4	150 35.9	40.3	130 32.7	01.4	117 36.6	18.5	299 00.8	55.7
21	147 49.8	165 35.5	. . 39.2	145 33.4	S 00.6	132 38.5	. . 18.7	314 03.5	. . 55.7
22	162 52.3	180 35.1	38.2	160 34.1	N 00.2	147 40.4	18.9	329 06.1	55.6
23	177 54.8	195 34.7	37.1	175 34.8	00.9	162 42.3	19.2	344 08.7	55.5
5 00	192 57.2	210 34.3	S 8 36.1	190 35.5	N 0 01.7	177 44.2	N 5 19.4	359 11.4	S 2 55.4
01	207 59.7	225 34.0	35.0	205 36.2	02.5	192 46.1	19.6	14 14.0	55.4
02	223 02.2	240 33.6	34.0	220 36.8	03.3	207 48.0	19.9	29 16.7	55.3
03	238 04.6	255 33.2	. . 32.9	235 37.5	. . 04.1	222 49.9	. . 20.1	44 19.3	. . 55.2
04	253 07.1	270 32.8	31.9	250 38.2	04.9	237 51.8	20.3	59 22.0	55.1
05	268 09.6	285 32.4	30.8	265 38.9	05.7	252 53.7	20.6	74 24.6	55.0
06	283 12.0	300 32.0	S 8 29.8	280 39.6	N 0 06.5	267 55.6	N 5 20.8	89 27.2	S 2 55.0
07	298 14.5	315 31.6	28.7	295 40.3	07.2	282 57.5	21.0	104 29.9	54.9
T 08	313 17.0	330 31.2	27.7	310 41.0	08.0	297 59.4	21.3	119 32.5	54.8
U 09	328 19.4	345 30.8	. . 26.6	325 41.6	. . 08.8	313 01.3	. . 21.5	134 35.2	. . 54.7
E 10	343 21.9	0 30.4	25.6	340 42.3	09.6	328 03.2	21.7	149 37.8	54.7
S 11	358 24.3	15 30.0	24.5	355 43.0	10.4	343 05.1	22.0	164 40.5	54.6
D 12	13 26.8	30 29.7	S 8 23.5	10 43.7	N 0 11.2	358 07.0	N 5 22.2	179 43.1	S 2 54.5
A 13	28 29.3	45 29.3	22.4	25 44.4	12.0	13 08.9	22.4	194 45.7	54.4
Y 14	43 31.7	60 28.9	21.3	40 45.1	12.8	28 10.8	22.7	209 48.4	54.4
15	58 34.2	75 28.5	. . 20.3	55 45.8	. . 13.5	43 12.7	. . 22.9	224 51.0	. . 54.3
16	73 36.7	90 28.1	19.2	70 46.4	14.3	58 14.6	23.1	239 53.7	54.2
17	88 39.1	105 27.7	18.2	85 47.1	15.1	73 16.5	23.4	254 56.3	54.1
18	103 41.6	120 27.3	S 8 17.1	100 47.8	N 0 15.9	88 18.4	N 5 23.6	269 59.0	S 2 54.1
19	118 44.1	135 26.9	16.1	115 48.5	16.7	103 20.3	23.8	285 01.6	54.0
20	133 46.5	150 26.6	15.0	130 49.2	17.5	118 22.2	24.1	300 04.3	53.9
21	148 49.0	165 26.2	. . 13.9	145 49.9	. . 18.3	133 24.1	. . 24.3	315 06.9	. . 53.8
22	163 51.4	180 25.8	12.9	160 50.6	19.0	148 26.1	24.5	330 09.5	53.8
23	178 53.9	195 25.4	11.8	175 51.2	19.8	163 28.0	24.8	345 12.2	53.7
6 00	193 56.4	210 25.0	S 8 10.8	190 51.9	N 0 20.6	178 29.9	N 5 25.0	0 14.8	S 2 53.6
01	208 58.8	225 24.6	09.7	205 52.6	21.4	193 31.8	25.2	15 17.5	53.5
02	224 01.3	240 24.2	08.6	220 53.3	22.2	208 33.7	25.5	30 20.1	53.5
03	239 03.8	255 23.9	. . 07.6	235 54.0	. . 23.0	223 35.6	. . 25.7	45 22.8	. . 53.4
04	254 06.2	270 23.5	06.5	250 54.7	23.8	238 37.5	25.9	60 25.4	53.3
05	269 08.7	285 23.1	05.5	265 55.4	24.5	253 39.4	26.2	75 28.0	53.2
06	284 11.2	300 22.7	S 8 04.4	280 56.1	N 0 25.3	268 41.3	N 5 26.4	90 30.7	S 2 53.2
W 07	299 13.6	315 22.3	03.3	295 56.7	26.1	283 43.2	26.6	105 33.3	53.1
E 08	314 16.1	330 21.9	02.3	310 57.4	26.9	298 45.1	26.8	120 36.0	53.0
D 09	329 18.6	345 21.5	. . 01.2	325 58.1	. . 27.7	313 47.0	. . 27.1	135 38.6	. . 52.9
N 10	344 21.0	0 21.2	8 00.1	340 58.8	28.5	328 48.9	27.3	150 41.3	52.9
E 11	359 23.5	15 20.8	7 59.1	355 59.5	29.3	343 50.8	27.5	165 43.9	52.8
S 12	14 25.9	30 20.4	S 7 58.0	11 00.2	N 0 30.1	358 52.7	N 5 27.8	180 46.5	S 2 52.7
D 13	29 28.4	45 20.0	57.0	26 00.9	30.8	13 54.6	28.0	195 49.2	52.6
A 14	44 30.9	60 19.6	55.9	41 01.5	31.6	28 56.5	28.2	210 51.8	52.6
Y 15	59 33.3	75 19.2	. . 54.8	56 02.2	. . 32.4	43 58.4	. . 28.5	225 54.5	. . 52.5
16	74 35.8	90 18.9	53.8	71 02.9	33.2	59 00.3	28.7	240 57.1	52.4
17	89 38.3	105 18.5	52.7	86 03.6	34.0	74 02.2	28.9	255 59.8	52.3
18	104 40.7	120 18.1	S 7 51.6	101 04.3	N 0 34.8	89 04.1	N 5 29.2	271 02.4	S 2 52.3
19	119 43.2	135 17.7	50.6	116 05.0	35.6	104 06.0	29.4	286 05.0	52.2
20	134 45.7	150 17.3	49.5	131 05.7	36.3	119 07.9	29.6	301 07.7	52.1
21	149 48.1	165 17.0	. . 48.4	146 06.4	. . 37.1	134 09.8	. . 29.9	316 10.3	. . 52.0
22	164 50.6	180 16.6	47.4	161 07.0	37.9	149 11.7	30.1	331 13.0	52.0
23	179 53.1	195 16.2	46.3	176 07.7	38.7	164 13.6	30.3	346 15.6	51.9
	h m								
Mer. Pass.	11 06.4	*v* −0.4	*d* 1.1	*v* 0.7	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.7
Achernar	335 28.4	S57 10.8
Acrux	173 10.5	S63 09.9
Adhara	255 13.8	S28 59.6
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.4	N55 53.8
Alkaid	152 59.6	N49 15.2
Al Na'ir	27 46.0	S46 54.2
Alnilam	275 48.1	S 1 11.9
Alphard	217 57.5	S 8 42.7
Alphecca	126 12.0	N26 40.4
Alpheratz	357 45.5	N29 09.1
Altair	62 09.8	N 8 53.8
Ankaa	353 17.6	S42 14.6
Antares	112 28.0	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 31.0	S69 02.6
Avior	234 18.5	S59 33.1
Bellatrix	278 33.8	N 6 21.5
Betelgeuse	271 03.1	N 7 24.4
Canopus	263 56.9	S52 42.5
Capella	280 37.0	N46 00.6
Deneb	49 32.8	N45 19.0
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.5
Dubhe	193 52.9	N61 41.4
Elnath	278 14.8	N28 37.0
Eltanin	90 46.7	N51 29.0
Enif	33 48.9	N 9 55.5
Fomalhaut	15 26.0	S29 33.7
Gacrux	172 02.2	S57 10.8
Gienah	175 53.6	S17 36.5
Hadar	148 49.6	S60 25.7
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.8	S34 22.6
Kochab	137 18.7	N74 06.3
Markab	13 40.2	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.1	S36 25.6
Miaplacidus	221 39.7	S69 46.2
Mirfak	308 43.1	N49 54.1
Nunki	76 00.2	S26 16.9
Peacock	53 21.8	S56 41.6
Pollux	243 29.6	N27 59.9
Procyon	245 01.3	N 5 11.6
Rasalhague	96 07.8	N12 32.9
Regulus	207 44.9	N11 54.5
Rigel	281 13.7	S 8 11.5
Rigil Kent.	139 53.4	S60 52.9
Sabik	102 14.2	S15 44.4
Schedar	349 43.0	N56 35.9
Shaula	96 23.9	S37 06.6
Sirius	258 35.1	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.4	S43 29.1
Vega	80 40.0	N38 47.4
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	17 37.1	9 58
Mars	357 38.2	11 17
Jupiter	344 46.9	12 08
Saturn	166 14.1	0 03

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
4 00	179 11.6	N 5 28.6	177 00.1	15.1	N11 25.5	10.6	54.0
01	194 11.8	29.5	191 34.2	15.1	11 36.1	10.4	54.0
02	209 12.0	30.5	206 08.3	15.1	11 46.5	10.5	54.1
03	224 12.1	. . 31.5	220 42.4	15.0	11 57.0	10.4	54.1
04	239 12.3	32.4	235 16.4	14.9	12 07.4	10.3	54.1
05	254 12.5	33.4	249 50.3	14.9	12 17.7	10.3	54.1
06	269 12.7	N 5 34.3	264 24.2	14.9	N12 28.0	10.2	54.1
07	284 12.9	35.3	278 58.1	14.9	12 38.2	10.2	54.1
08	299 13.0	36.2	293 32.0	14.7	12 48.4	10.2	54.1
M 09	314 13.2	. . 37.2	308 05.7	14.8	12 58.6	10.1	54.1
O 10	329 13.4	38.1	322 39.5	14.7	13 08.7	10.0	54.1
N 11	344 13.6	39.1	337 13.2	14.6	13 18.7	10.0	54.1
D 12	359 13.8	N 5 40.1	351 46.8	14.6	N13 28.7	9.9	54.1
A 13	14 13.9	41.0	6 20.4	14.6	13 38.6	9.9	54.1
Y 14	29 14.1	42.0	20 54.0	14.5	13 48.5	9.9	54.1
15	44 14.3	. . 42.9	35 27.5	14.4	13 58.4	9.7	54.1
16	59 14.5	43.9	50 00.9	14.4	14 08.1	9.8	54.2
17	74 14.7	44.8	64 34.3	14.4	14 17.9	9.6	54.2
18	89 14.9	N 5 45.8	79 07.7	14.3	N14 27.5	9.6	54.2
19	104 15.0	46.7	93 41.0	14.2	14 37.1	9.6	54.2
20	119 15.2	47.7	108 14.2	14.2	14 46.7	9.5	54.2
21	134 15.4	. . 48.6	122 47.4	14.2	14 56.2	9.4	54.2
22	149 15.6	49.6	137 20.6	14.1	15 05.6	9.4	54.2
23	164 15.8	50.5	151 53.7	14.0	15 15.0	9.3	54.2
5 00	179 15.9	N 5 51.5	166 26.7	14.0	N15 24.3	9.2	54.2
01	194 16.1	52.4	180 59.7	13.9	15 33.5	9.2	54.2
02	209 16.3	53.4	195 32.6	13.9	15 42.7	9.1	54.2
03	224 16.5	. . 54.3	210 05.5	13.8	15 51.8	9.1	54.3
04	239 16.7	55.3	224 38.3	13.8	16 00.9	9.0	54.3
05	254 16.8	56.2	239 11.1	13.7	16 09.9	8.9	54.3
06	269 17.0	N 5 57.2	253 43.8	13.7	N16 18.8	8.8	54.3
07	284 17.2	58.2	268 16.5	13.6	16 27.6	8.8	54.3
T 08	299 17.4	5 59.1	282 49.1	13.6	16 36.4	8.7	54.3
U 09	314 17.5	6 00.1	297 21.7	13.5	16 45.1	8.7	54.3
E 10	329 17.7	01.0	311 54.2	13.4	16 53.8	8.6	54.3
S 11	344 17.9	02.0	326 26.6	13.4	17 02.4	8.5	54.3
D 12	359 18.1	N 6 02.9	340 59.0	13.3	N17 10.9	8.4	54.3
A 13	14 18.3	03.9	355 31.3	13.3	17 19.3	8.4	54.4
Y 14	29 18.4	04.8	10 03.6	13.2	17 27.7	8.3	54.4
15	44 18.6	. . 05.8	24 35.8	13.2	17 36.0	8.2	54.4
16	59 18.8	06.7	39 08.0	13.1	17 44.2	8.1	54.4
17	74 19.0	07.6	53 40.1	13.0	17 52.3	8.1	54.4
18	89 19.2	N 6 08.6	68 12.1	13.0	N18 00.4	8.0	54.4
19	104 19.3	09.5	82 44.1	12.9	18 08.4	7.9	54.4
20	119 19.5	10.5	97 16.0	12.9	18 16.3	7.8	54.4
21	134 19.7	. . 11.4	111 47.9	12.8	18 24.1	7.8	54.5
22	149 19.9	12.4	126 19.7	12.7	18 31.9	7.7	54.5
23	164 20.0	13.3	140 51.4	12.7	18 39.6	7.6	54.5
6 00	179 20.2	N 6 14.3	155 23.1	12.6	N18 47.2	7.5	54.5
01	194 20.4	15.2	169 54.7	12.6	18 54.7	7.4	54.5
02	209 20.6	16.2	184 26.3	12.5	19 02.1	7.4	54.5
03	224 20.8	. . 17.1	198 57.8	12.5	19 09.5	7.2	54.5
04	239 20.9	18.1	213 29.3	12.4	19 16.7	7.2	54.6
05	254 21.1	19.0	228 00.7	12.3	19 23.9	7.1	54.6
06	269 21.3	N 6 20.0	242 32.0	12.3	N19 31.0	7.0	54.6
W 07	284 21.5	20.9	257 03.3	12.2	19 38.0	6.9	54.6
E 08	299 21.6	21.9	271 34.5	12.2	19 44.9	6.9	54.6
D 09	314 21.8	. . 22.8	286 05.7	12.1	19 51.8	6.7	54.6
N 10	329 22.0	23.8	300 36.8	12.0	19 58.5	6.7	54.6
E 11	344 22.2	24.7	315 07.8	12.0	20 05.2	6.5	54.7
S 12	359 22.4	N 6 25.6	329 38.8	11.9	N20 11.7	6.5	54.7
D 13	14 22.5	26.6	344 09.7	11.9	20 18.2	6.4	54.7
A 14	29 22.7	27.5	358 40.6	11.8	20 24.6	6.3	54.7
Y 15	44 22.9	. . 28.5	13 11.4	11.7	20 30.9	6.2	54.7
16	59 23.1	29.4	27 42.1	11.7	20 37.1	6.1	54.7
17	74 23.2	30.4	42 12.8	11.6	20 43.2	6.0	54.7
18	89 23.4	N 6 31.3	56 43.4	11.6	N20 49.2	5.9	54.8
19	104 23.6	32.3	71 14.0	11.5	20 55.1	5.8	54.8
20	119 23.8	33.2	85 44.5	11.5	21 00.9	5.7	54.8
21	134 23.9	. . 34.1	100 15.0	11.4	21 06.6	5.7	54.8
22	149 24.1	35.1	114 45.4	11.3	21 12.3	5.5	54.8
23	164 24.3	36.0	129 15.7	11.3	N21 17.8	5.4	54.8
	SD 16.0	d 0.9	SD 14.7		14.8		14.9

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 4	Moonrise 5	Moonrise 6	Moonrise 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	00 31	03 18	04 37	03 35	02 58	▭	▭
N 70	01 49	03 38	04 46	03 56	03 35	02 57	▭
68	02 25	03 53	04 54	04 11	04 02	03 48	03 19
66	02 50	04 05	05 00	04 24	04 22	04 20	04 21
64	03 09	04 15	05 06	04 35	04 38	04 44	04 56
62	03 24	04 24	05 10	04 45	04 52	05 03	05 21
60	03 36	04 31	05 15	04 53	05 04	05 19	05 41
N 58	03 47	04 37	05 18	05 00	05 14	05 32	05 58
56	03 56	04 43	05 21	05 06	05 22	05 44	06 12
54	04 03	04 48	05 24	05 12	05 30	05 54	06 24
52	04 10	04 52	05 27	05 17	05 37	06 03	06 35
50	04 16	04 56	05 29	05 21	05 44	06 11	06 44
45	04 29	05 04	05 34	05 31	05 58	06 28	07 05
N 40	04 38	05 11	05 38	05 40	06 09	06 42	07 21
35	04 46	05 16	05 42	05 47	06 19	06 54	07 35
30	04 53	05 21	05 45	05 53	06 27	07 05	07 47
20	05 03	05 28	05 51	06 04	06 42	07 23	08 08
N 10	05 10	05 34	05 55	06 14	06 55	07 39	08 26
0	05 15	05 39	06 00	06 23	07 08	07 54	08 43
S 10	05 18	05 43	06 04	06 33	07 20	08 09	09 00
20	05 20	05 46	06 08	06 43	07 33	08 25	09 18
30	05 21	05 49	06 13	06 54	07 48	08 44	09 39
35	05 21	05 50	06 16	07 01	07 57	08 55	09 52
40	05 20	05 51	06 19	07 08	08 08	09 07	10 06
45	05 19	05 53	06 22	07 17	08 20	09 22	10 23
S 50	05 16	05 54	06 26	07 28	08 34	09 40	10 44
52	05 15	05 54	06 28	07 33	08 41	09 49	10 54
54	05 14	05 55	06 30	07 38	08 49	09 58	11 05
56	05 12	05 55	06 32	07 45	08 57	10 09	11 18
58	05 10	05 56	06 35	07 52	09 07	10 22	11 33
S 60	05 08	05 56	06 38	07 59	09 18	10 37	11 51

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 4	Moonset 5	Moonset 6	Moonset 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	19 32	20 52	////	22 36	▭	▭	▭
N 70	19 22	20 32	22 25	22 00	24 13	00 13	▭
68	19 14	20 16	21 46	21 35	23 23	25 33	01 33
66	19 07	20 03	21 20	21 16	22 52	24 31	00 31
64	19 02	19 53	21 00	21 00	22 29	23 57	25 18
62	18 57	19 44	20 45	20 48	22 10	23 32	24 46
60	18 53	19 36	20 32	20 37	21 55	23 12	24 23
N 58	18 49	19 30	20 21	20 28	21 43	22 56	24 04
56	18 46	19 24	20 12	20 19	21 32	22 42	23 48
54	18 43	19 19	20 04	20 12	21 22	22 31	23 35
52	18 40	19 15	19 57	20 06	21 14	22 20	23 23
50	18 38	19 11	19 51	20 00	21 06	22 11	23 13
45	18 32	19 02	19 38	19 47	20 50	21 51	22 51
N 40	18 28	18 55	19 28	19 37	20 36	21 35	22 33
35	18 24	18 50	19 20	19 28	20 25	21 22	22 18
30	18 21	18 45	19 13	19 20	20 15	21 10	22 06
20	18 15	18 37	19 03	19 07	19 58	20 51	21 44
N 10	18 10	18 32	18 56	18 55	19 43	20 33	21 25
0	18 06	18 27	18 51	18 44	19 30	20 17	21 07
S 10	18 02	18 23	18 47	18 34	19 16	20 01	20 49
20	17 57	18 19	18 45	18 22	19 01	19 44	20 31
30	17 52	18 16	18 44	18 09	18 45	19 24	20 09
35	17 50	18 15	18 44	18 01	18 35	19 13	19 56
40	17 46	18 13	18 45	17 53	18 24	19 00	19 41
45	17 43	18 12	18 46	17 43	18 11	18 44	19 24
S 50	17 39	18 11	18 48	17 31	17 55	18 25	19 02
52	17 37	18 10	18 49	17 25	17 48	18 16	18 52
54	17 34	18 10	18 51	17 19	17 40	18 06	18 41
56	17 32	18 09	18 52	17 12	17 31	17 55	18 27
58	17 30	18 09	18 54	17 05	17 20	17 42	18 12
S 60	17 27	18 08	18 56	16 56	17 09	17 27	17 54

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
4	03 14	03 05	12 03	12 34	00 12	01	1
5	02 57	02 48	12 03	13 18	00 56	02	3
6	02 39	02 31	12 03	14 05	01 42	03	8

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
7 00	194 55.5	210 15.8	S 7 45.2	191 08.4	N 0 39.5	179 15.5	N 5 30.6	1 18.3	S 2 51.8
01	209 58.0	225 15.4	44.1	206 09.1	40.3	194 17.4	30.8	16 20.9	51.7
02	225 00.4	240 15.1	43.1	221 09.8	41.0	209 19.3	31.0	31 23.5	51.7
03	240 02.9	255 14.7	42.0	236 10.5	41.8	224 21.2	31.3	46 26.2	51.6
04	255 05.4	270 14.3	40.9	251 11.2	42.6	239 23.1	31.5	61 28.8	51.5
05	270 07.8	285 13.9	39.9	266 11.9	43.4	254 25.1	31.7	76 31.5	51.4
06	285 10.3	300 13.5	S 7 38.8	281 12.5	N 0 44.2	269 27.0	N 5 32.0	91 34.1	S 2 51.4
07	300 12.8	315 13.2	37.7	296 13.2	45.0	284 28.9	32.2	106 36.8	51.3
T 08	315 15.2	330 12.8	36.6	311 13.9	45.8	299 30.8	32.4	121 39.4	51.2
H 09	330 17.7	345 12.4	35.6	326 14.6	46.5	314 32.7	32.7	136 42.0	51.1
U 10	345 20.2	0 12.0	34.5	341 15.3	47.3	329 34.6	32.9	151 44.7	51.1
R 11	0 22.6	15 11.7	33.4	356 16.0	48.1	344 36.5	33.1	166 47.3	51.0
S 12	15 25.1	30 11.3	S 7 32.4	11 16.7	N 0 48.9	359 38.4	N 5 33.3	181 50.0	S 2 50.9
D 13	30 27.5	45 10.9	31.3	26 17.4	49.7	14 40.3	33.6	196 52.6	50.8
A 14	45 30.0	60 10.5	30.2	41 18.0	50.5	29 42.2	33.8	211 55.3	50.8
Y 15	60 32.5	75 10.1	29.1	56 18.7	51.3	44 44.1	34.0	226 57.9	50.7
16	75 34.9	90 09.8	28.1	71 19.4	52.0	59 46.0	34.3	242 00.5	50.6
17	90 37.4	105 09.4	27.0	86 20.1	52.8	74 47.9	34.5	257 03.2	50.5
18	105 39.9	120 09.0	S 7 25.9	101 20.8	N 0 53.6	89 49.8	N 5 34.7	272 05.8	S 2 50.5
19	120 42.3	135 08.6	24.8	116 21.5	54.4	104 51.7	35.0	287 08.5	50.4
20	135 44.8	150 08.3	23.7	131 22.2	55.2	119 53.6	35.2	302 11.1	50.3
21	150 47.3	165 07.9	22.7	146 22.9	56.0	134 55.5	35.4	317 13.8	50.2
22	165 49.7	180 07.5	21.6	161 23.5	56.8	149 57.4	35.7	332 16.4	50.2
23	180 52.2	195 07.1	20.5	176 24.2	57.5	164 59.3	35.9	347 19.0	50.1
8 00	195 54.7	210 06.8	S 7 19.4	191 24.9	N 0 58.3	180 01.2	N 5 36.1	2 21.7	S 2 50.0
01	210 57.1	225 06.4	18.4	206 25.6	59.1	195 03.1	36.4	17 24.3	49.9
02	225 59.6	240 06.0	17.3	221 26.3	0 59.9	210 05.0	36.6	32 27.0	49.9
03	241 02.0	255 05.6	16.2	236 27.0	1 00.7	225 06.9	36.8	47 29.6	49.8
04	256 04.5	270 05.3	15.1	251 27.7	01.5	240 08.8	37.1	62 32.3	49.7
05	271 07.0	285 04.9	14.0	266 28.4	02.2	255 10.7	37.3	77 34.9	49.6
06	286 09.4	300 04.5	S 7 13.0	281 29.1	N 1 03.0	270 12.6	N 5 37.5	92 37.5	S 2 49.6
07	301 11.9	315 04.2	11.9	296 29.7	03.8	285 14.5	37.8	107 40.2	49.5
08	316 14.4	330 03.8	10.8	311 30.4	04.6	300 16.4	38.0	122 42.8	49.4
F 09	331 16.8	345 03.4	09.7	326 31.1	05.4	315 18.3	38.2	137 45.5	49.3
R 10	346 19.3	0 03.0	08.6	341 31.8	06.2	330 20.2	38.5	152 48.1	49.3
I 11	1 21.8	15 02.7	07.5	356 32.5	06.9	345 22.1	38.7	167 50.8	49.2
D 12	16 24.2	30 02.3	S 7 06.5	11 33.2	N 1 07.7	0 24.0	N 5 38.9	182 53.4	S 2 49.1
A 13	31 26.7	45 01.9	05.4	26 33.9	08.5	15 25.9	39.1	197 56.0	49.0
Y 14	46 29.2	60 01.6	04.3	41 34.6	09.3	30 27.9	39.4	212 58.7	49.0
15	61 31.6	75 01.2	03.2	56 35.2	10.1	45 29.8	39.6	228 01.3	48.9
16	76 34.1	90 00.8	02.1	71 35.9	10.9	60 31.7	39.8	243 04.0	48.8
17	91 36.5	105 00.4	01.0	86 36.6	11.6	75 33.6	40.1	258 06.6	48.7
18	106 39.0	120 00.1	S 7 00.0	101 37.3	N 1 12.4	90 35.5	N 5 40.3	273 09.3	S 2 48.7
19	121 41.5	134 59.7	6 58.9	116 38.0	13.2	105 37.4	40.5	288 11.9	48.6
20	136 43.9	149 59.3	57.8	131 38.7	14.0	120 39.3	40.8	303 14.5	48.5
21	151 46.4	164 59.0	56.7	146 39.4	14.8	135 41.2	41.0	318 17.2	48.4
22	166 48.9	179 58.6	55.6	161 40.1	15.6	150 43.1	41.2	333 19.8	48.4
23	181 51.3	194 58.2	54.5	176 40.8	16.3	165 45.0	41.5	348 22.5	48.3
9 00	196 53.8	209 57.9	S 6 53.4	191 41.4	N 1 17.1	180 46.9	N 5 41.7	3 25.1	S 2 48.2
01	211 56.3	224 57.5	52.4	206 42.1	17.9	195 48.8	41.9	18 27.8	48.1
02	226 58.7	239 57.1	51.3	221 42.8	18.7	210 50.7	42.2	33 30.4	48.1
03	242 01.2	254 56.7	50.2	236 43.5	19.5	225 52.6	42.4	48 33.0	48.0
04	257 03.6	269 56.4	49.1	251 44.2	20.3	240 54.5	42.6	63 35.7	47.9
05	272 06.1	284 56.0	48.0	266 44.9	21.0	255 56.4	42.8	78 38.3	47.8
06	287 08.6	299 55.6	S 6 46.9	281 45.6	N 1 21.8	270 58.3	N 5 43.1	93 41.0	S 2 47.8
07	302 11.0	314 55.3	45.8	296 46.3	22.6	286 00.2	43.3	108 43.6	47.7
S 08	317 13.5	329 54.9	44.7	311 47.0	23.4	301 02.1	43.5	123 46.3	47.6
A 09	332 16.0	344 54.5	43.6	326 47.7	24.2	316 04.0	43.8	138 48.9	47.5
T 10	347 18.4	359 54.2	42.5	341 48.3	25.0	331 05.9	44.0	153 51.5	47.5
U 11	2 20.9	14 53.8	41.5	356 49.0	25.7	346 07.8	44.2	168 54.2	47.4
R 12	17 23.4	29 53.4	S 6 40.4	11 49.7	N 1 26.5	1 09.7	N 5 44.5	183 56.8	S 2 47.3
D 13	32 25.8	44 53.1	39.3	26 50.4	27.3	16 11.6	44.7	198 59.5	47.2
A 14	47 28.3	59 52.7	38.2	41 51.1	28.1	31 13.5	44.9	214 02.1	47.2
Y 15	62 30.8	74 52.3	37.1	56 51.8	28.9	46 15.4	45.2	229 04.7	47.1
16	77 33.2	89 52.0	36.0	71 52.5	29.7	61 17.3	45.4	244 07.4	47.0
17	92 35.7	104 51.6	34.9	86 53.2	30.4	76 19.2	45.6	259 10.0	47.0
18	107 38.1	119 51.2	S 6 33.8	101 53.9	N 1 31.2	91 21.1	N 5 45.9	274 12.7	S 2 46.9
19	122 40.6	134 50.9	32.7	116 54.5	32.0	106 23.0	46.1	289 15.3	46.8
20	137 43.1	149 50.5	31.6	131 55.2	32.8	121 24.9	46.3	304 18.0	46.7
21	152 45.5	164 50.2	30.5	146 55.9	33.6	136 26.8	46.5	319 20.6	46.7
22	167 48.0	179 49.8	29.4	161 56.6	34.4	151 28.7	46.8	334 23.2	46.6
23	182 50.5	194 49.4	28.3	176 57.3	35.1	166 30.6	47.0	349 25.9	46.5
	h m								
Mer. Pass.	10 54.6	v −0.4	d 1.1	v 0.7	d 0.8	v 1.9	d 0.2	v 2.6	d 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.7
Achernar	335 28.4	S57 10.8
Acrux	173 10.5	S63 09.9
Adhara	255 13.8	S28 59.6
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.4	N55 53.8
Alkaid	152 59.6	N49 15.2
Al Na'ir	27 45.9	S46 54.2
Alnilam	275 48.1	S 1 11.9
Alphard	217 57.5	S 8 42.7
Alphecca	126 12.0	N26 40.4
Alpheratz	357 45.5	N29 09.1
Altair	62 09.8	N 8 53.8
Ankaa	353 17.6	S42 14.6
Antares	112 28.0	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 31.0	S69 02.7
Avior	234 18.6	S59 33.1
Bellatrix	278 33.8	N 6 21.5
Betelgeuse	271 03.1	N 7 24.4
Canopus	263 57.0	S52 42.5
Capella	280 37.0	N46 00.6
Deneb	49 32.8	N45 19.0
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.5
Dubhe	193 52.9	N61 41.4
Elnath	278 14.8	N28 37.0
Eltanin	90 46.7	N51 29.0
Enif	33 48.9	N 9 55.5
Fomalhaut	15 26.0	S29 33.7
Gacrux	172 02.2	S57 10.8
Gienah	175 53.6	S17 36.5
Hadar	148 49.6	S60 25.7
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.8	S34 22.6
Kochab	137 18.7	N74 06.3
Markab	13 40.2	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.1	S36 25.6
Miaplacidus	221 39.7	S69 46.2
Mirfak	308 43.1	N49 54.1
Nunki	76 00.2	S26 16.9
Peacock	53 21.8	S56 41.6
Pollux	243 29.6	N27 59.9
Procyon	245 01.3	N 5 11.6
Rasalhague	96 07.8	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.7	S 8 11.5
Rigil Kent.	139 53.3	S60 52.9
Sabik	102 14.2	S15 44.4
Schedar	349 43.0	N56 35.9
Shaula	96 23.9	S37 06.6
Sirius	258 35.2	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.4	S43 29.1
Vega	80 40.0	N38 47.4
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	14 12.1	10 00
Mars	355 30.3	11 14
Jupiter	344 06.6	11 58
Saturn	166 27.0	23 46

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
7 00	179 24.5	N 6 37.0	143 46.0	11.2	N21 23.2	5.3	54.9
01	194 24.7	37.9	158 16.2	11.2	21 28.5	5.3	54.9
02	209 24.8	38.9	172 46.4	11.1	21 33.8	5.1	54.9
03	224 25.0	39.8	187 16.5	11.0	21 38.9	5.0	54.9
04	239 25.2	40.7	201 46.5	11.0	21 43.9	4.9	54.9
05	254 25.4	41.7	216 16.5	11.0	21 48.8	4.8	54.9
06	269 25.5	N 6 42.6	230 46.5	10.9	N21 53.6	4.7	55.0
07	284 25.7	43.6	245 16.4	10.8	21 58.3	4.6	55.0
08	299 25.9	44.5	259 46.2	10.8	22 02.9	4.5	55.0
09	314 26.1	45.5	274 16.0	10.7	22 07.4	4.4	55.0
10	329 26.2	46.4	288 45.7	10.7	22 11.8	4.3	55.0
11	344 26.4	47.3	303 15.4	10.6	22 16.1	4.2	55.1
12	359 26.6	N 6 48.3	317 45.0	10.6	N22 20.3	4.1	55.1
13	14 26.8	49.2	332 14.6	10.5	22 24.4	3.9	55.1
14	29 26.9	50.2	346 44.1	10.5	22 28.3	3.9	55.1
15	44 27.1	51.1	1 13.6	10.4	22 32.2	3.7	55.1
16	59 27.3	52.0	15 43.0	10.3	22 35.9	3.7	55.2
17	74 27.5	53.0	30 12.3	10.4	22 39.6	3.5	55.2
18	89 27.6	N 6 53.9	44 41.7	10.2	N22 43.1	3.4	55.2
19	104 27.8	54.9	59 10.9	10.2	22 46.5	3.3	55.2
20	119 28.0	55.8	73 40.1	10.2	22 49.8	3.2	55.2
21	134 28.2	56.7	88 09.3	10.1	22 53.0	3.0	55.3
22	149 28.3	57.7	102 38.4	10.1	22 56.0	3.0	55.3
23	164 28.5	58.6	117 07.5	10.0	22 59.0	2.8	55.3
8 00	179 28.7	N 6 59.5	131 36.5	10.0	N23 01.8	2.7	55.3
01	194 28.8	7 00.5	146 05.5	9.9	23 04.5	2.6	55.3
02	209 29.0	01.4	160 34.4	9.9	23 07.1	2.5	55.4
03	224 29.2	02.4	175 03.3	9.9	23 09.6	2.4	55.4
04	239 29.4	03.3	189 32.2	9.8	23 12.0	2.3	55.4
05	254 29.5	04.2	204 01.0	9.7	23 14.3	2.1	55.4
06	269 29.7	N 7 05.2	218 29.7	9.8	N23 16.4	2.0	55.4
07	284 29.9	06.1	232 58.5	9.6	23 18.4	1.9	55.5
08	299 30.1	07.0	247 27.1	9.7	23 20.3	1.8	55.5
09	314 30.2	08.0	261 55.8	9.6	23 22.1	1.6	55.5
10	329 30.4	08.9	276 24.4	9.5	23 23.7	1.6	55.5
11	344 30.6	09.9	290 52.9	9.5	23 25.3	1.4	55.6
12	359 30.8	N 7 10.8	305 21.4	9.5	N23 26.7	1.3	55.6
13	14 30.9	11.7	319 49.9	9.5	23 28.0	1.2	55.6
14	29 31.1	12.7	334 18.4	9.4	23 29.2	1.0	55.6
15	44 31.3	13.6	348 46.8	9.4	23 30.2	0.9	55.7
16	59 31.4	14.5	3 15.2	9.3	23 31.1	0.8	55.7
17	74 31.6	15.5	17 43.5	9.3	23 31.9	0.7	55.7
18	89 31.8	N 7 16.4	32 11.8	9.3	N23 32.6	0.6	55.7
19	104 32.0	17.3	46 40.1	9.2	23 33.2	0.4	55.8
20	119 32.1	18.3	61 08.3	9.2	23 33.6	0.3	55.8
21	134 32.3	19.2	75 36.5	9.2	23 33.9	0.2	55.8
22	149 32.5	20.1	90 04.7	9.2	23 34.1	0.0	55.8
23	164 32.6	21.1	104 32.9	9.1	23 34.1	0.0	55.9
9 00	179 32.8	N 7 22.0	119 01.0	9.1	N23 34.1	0.2	55.9
01	194 33.0	22.9	133 29.1	9.1	23 33.9	0.4	55.9
02	209 33.2	23.9	147 57.2	9.0	23 33.5	0.4	55.9
03	224 33.3	24.8	162 25.2	9.0	23 33.1	0.6	56.0
04	239 33.5	25.7	176 53.2	9.0	23 32.5	0.7	56.0
05	254 33.7	26.7	191 21.2	9.0	23 31.8	0.8	56.0
06	269 33.8	N 7 27.6	205 49.2	8.9	N23 31.0	1.0	56.0
07	284 34.0	28.5	220 17.1	8.9	23 30.0	1.1	56.1
08	299 34.2	29.5	234 45.0	9.0	23 28.9	1.2	56.1
09	314 34.4	30.4	249 13.0	8.8	23 27.7	1.3	56.1
10	329 34.5	31.3	263 40.8	8.9	23 26.4	1.5	56.1
11	344 34.7	32.3	278 08.7	8.8	23 24.9	1.6	56.2
12	359 34.9	N 7 33.2	292 36.5	8.9	N23 23.3	1.7	56.2
13	14 35.0	34.1	307 04.4	8.8	23 21.6	1.9	56.2
14	29 35.2	35.0	321 32.2	8.8	23 19.7	2.0	56.3
15	44 35.4	36.0	336 00.0	8.8	23 17.7	2.1	56.3
16	59 35.5	36.9	350 27.8	8.7	23 15.6	2.2	56.3
17	74 35.7	37.8	4 55.5	8.8	23 13.4	2.4	56.3
18	89 35.9	N 7 38.8	19 23.3	8.7	N23 11.0	2.5	56.4
19	104 36.1	39.7	33 51.0	8.8	23 08.5	2.7	56.4
20	119 36.2	40.6	48 18.8	8.7	23 05.8	2.7	56.4
21	134 36.4	41.5	62 46.5	8.7	23 03.1	2.9	56.5
22	149 36.6	42.5	77 14.2	8.7	23 00.2	3.0	56.5
23	164 36.7	43.4	91 41.9	8.7	N22 57.2	3.2	56.5
	SD 16.0	d 0.9	SD	15.0		15.1	15.3

THURSDAY

FRIDAY

SATURDAY

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 7	Moonrise 8	Moonrise 9	Moonrise 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	02 58	04 21				
N 70	01 15	03 21	04 32				
68	02 03	03 38	04 41	03 19			
66	02 33	03 52	04 49	04 21	04 29	05 09	06 39
64	02 54	04 04	04 55	04 56	05 20	06 07	07 22
62	03 11	04 13	05 01	05 21	05 51	06 40	07 51
60	03 25	04 21	05 05	05 41	06 15	07 05	08 12
N 58	03 37	04 28	05 10	05 58	06 34	07 25	08 30
56	03 46	04 35	05 13	06 12	06 50	07 41	08 45
54	03 55	04 40	05 17	06 24	07 04	07 55	08 58
52	04 02	04 45	05 20	06 35	07 16	08 07	09 09
50	04 09	04 49	05 23	06 44	07 26	08 18	09 19
45	04 23	04 59	05 29	07 05	07 48	08 40	09 40
N 40	04 33	05 06	05 34	07 21	08 06	08 58	09 57
35	04 42	05 12	05 38	07 35	08 21	09 14	10 11
30	04 49	05 17	05 42	07 47	08 34	09 27	10 24
20	05 00	05 26	05 48	08 08	08 56	09 49	10 45
N 10	05 08	05 32	05 54	08 26	09 16	10 09	11 03
0	05 14	05 38	05 59	08 43	09 34	10 27	11 20
S 10	05 18	05 43	06 04	09 00	09 52	10 45	11 37
20	05 21	05 47	06 09	09 18	10 12	11 04	11 56
30	05 23	05 51	06 15	09 39	10 34	11 27	12 17
35	05 23	05 52	06 18	09 52	10 47	11 40	12 29
40	05 23	05 54	06 22	10 06	11 02	11 55	12 43
45	05 22	05 56	06 26	10 23	11 21	12 13	13 00
S 50	05 21	05 58	06 31	10 44	11 43	12 36	13 20
52	05 20	05 59	06 33	10 54	11 54	12 46	13 30
54	05 19	06 00	06 36	11 05	12 06	12 59	13 41
56	05 18	06 01	06 38	11 18	12 21	13 13	13 53
58	05 17	06 02	06 42	11 33	12 37	13 29	14 08
S 60	05 15	06 03	06 45	11 51	12 57	13 48	14 24

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 7	Moonset 8	Moonset 9	Moonset 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	19 47	21 12	////				
N 70	19 35	20 47	23 03				
68	19 25	20 29	22 08	01 33			
66	19 17	20 15	21 36	00 31	02 08	03 18	03 39
64	19 11	20 03	21 13	25 18	01 18	02 20	02 56
62	19 05	19 53	20 56	24 46	00 46	01 46	02 27
60	19 00	19 44	20 41	24 23	00 23	01 22	02 05
N 58	18 56	19 37	20 30	24 04	00 04	01 02	01 47
56	18 52	19 31	20 19	23 48	24 46	00 46	01 32
54	18 48	19 25	20 11	23 35	24 32	00 32	01 19
52	18 45	19 20	20 03	23 23	24 19	00 19	01 07
50	18 42	19 16	19 56	23 13	24 09	00 09	00 57
45	18 36	19 06	19 42	22 51	23 46	24 36	00 36
N 40	18 31	18 59	19 31	22 33	23 28	24 18	00 18
35	18 27	18 52	19 23	22 18	23 13	24 04	00 04
30	18 23	18 47	19 16	22 06	23 00	23 51	24 39
20	18 16	18 38	19 04	21 44	22 37	23 29	24 19
N 10	18 10	18 32	18 56	21 25	22 17	23 10	24 02
0	18 05	18 26	18 50	21 07	21 59	22 52	23 46
S 10	18 00	18 21	18 46	20 49	21 41	22 35	23 30
20	17 55	18 17	18 43	20 31	21 21	22 16	23 13
30	17 49	18 13	18 41	20 09	20 59	21 53	22 52
35	17 46	18 11	18 40	19 56	20 45	21 40	22 41
40	17 42	18 09	18 40	19 41	20 30	21 25	22 27
45	17 37	18 07	18 41	19 24	20 12	21 08	22 11
S 50	17 32	18 05	18 42	19 02	19 49	20 45	21 51
52	17 30	18 04	18 43	18 52	19 38	20 35	21 42
54	17 27	18 03	18 44	18 41	19 26	20 23	21 31
56	17 24	18 02	18 45	18 27	19 12	20 09	21 19
58	17 21	18 01	18 46	18 12	18 55	19 53	21 05
S 60	17 18	18 00	18 48	17 54	18 35	19 34	20 49

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
7	02 22	02 14	12 02	14 55	02 30	04	14
8	02 06	01 57	12 02	15 47	03 20	05	21
9	01 49	01 41	12 02	16 40	04 13	06	30

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
10 00	197 52.9	209 49.1	S 6 27.2	191 58.0	N 1 35.9	181 32.5	N 5 47.2	4 28.5	S 2 46.4
01	212 55.4	224 48.7	26.1	206 58.7	36.7	196 34.4	47.5	19 31.2	46.4
02	227 57.9	239 48.3	25.1	221 59.4	37.5	211 36.4	47.7	34 33.8	46.3
03	243 00.3	254 48.0	. . 24.0	237 00.1	. . 38.3	226 38.3	. . 47.9	49 36.5	. . 46.2
04	258 02.8	269 47.6	22.9	252 00.8	39.0	241 40.2	48.2	64 39.1	46.1
05	273 05.3	284 47.2	21.8	267 01.4	39.8	256 42.1	48.4	79 41.7	46.1
06	288 07.7	299 46.9	S 6 20.7	282 02.1	N 1 40.6	271 44.0	N 5 48.6	94 44.4	S 2 46.0
07	303 10.2	314 46.5	19.6	297 02.8	41.4	286 45.9	48.9	109 47.0	45.9
08	318 12.6	329 46.2	18.5	312 03.5	42.2	301 47.8	49.1	124 49.7	45.8
S 09	333 15.1	344 45.8	. . 17.4	327 04.2	. . 43.0	316 49.7	. . 49.3	139 52.3	. . 45.8
U 10	348 17.6	359 45.4	16.3	342 04.9	43.7	331 51.6	49.6	154 54.9	45.7
N 11	3 20.0	14 45.1	15.2	357 05.6	44.5	346 53.5	49.8	169 57.6	45.6
D 12	18 22.5	29 44.7	S 6 14.1	12 06.3	N 1 45.3	1 55.4	N 5 50.0	185 00.2	S 2 45.5
A 13	33 25.0	44 44.3	13.0	27 07.0	46.1	16 57.3	50.2	200 02.9	45.5
Y 14	48 27.4	59 44.0	11.9	42 07.7	46.9	31 59.2	50.5	215 05.5	45.4
15	63 29.9	74 43.6	. . 10.8	57 08.4	. . 47.6	47 01.1	. . 50.7	230 08.2	. . 45.3
16	78 32.4	89 43.3	09.7	72 09.0	48.4	62 03.0	50.9	245 10.8	45.3
17	93 34.8	104 42.9	08.6	87 09.7	49.2	77 04.9	51.2	260 13.4	45.2
18	108 37.3	119 42.5	S 6 07.5	102 10.4	N 1 50.0	92 06.8	N 5 51.4	275 16.1	S 2 45.1
19	123 39.8	134 42.2	06.4	117 11.1	50.8	107 08.7	51.6	290 18.7	45.0
20	138 42.2	149 41.8	05.3	132 11.8	51.5	122 10.6	51.9	305 21.4	45.0
21	153 44.7	164 41.5	. . 04.2	147 12.5	. . 52.3	137 12.5	. . 52.1	320 24.0	. . 44.9
22	168 47.1	179 41.1	03.1	162 13.2	53.1	152 14.4	52.3	335 26.6	44.8
23	183 49.6	194 40.7	02.0	177 13.9	53.9	167 16.3	52.5	350 29.3	44.7
11 00	198 52.1	209 40.4	S 6 00.9	192 14.6	N 1 54.7	182 18.2	N 5 52.8	5 31.9	S 2 44.7
01	213 54.5	224 40.0	5 59.7	207 15.3	55.5	197 20.1	53.0	20 34.6	44.6
02	228 57.0	239 39.7	58.6	222 15.9	56.2	212 22.0	53.2	35 37.2	44.5
03	243 59.5	254 39.3	. . 57.5	237 16.6	. . 57.0	227 23.9	. . 53.5	50 39.9	. . 44.4
04	259 01.9	269 39.0	56.4	252 17.3	57.8	242 25.8	53.7	65 42.5	44.4
05	274 04.4	284 38.6	55.3	267 18.0	58.6	257 27.7	53.9	80 45.1	44.3
06	289 06.9	299 38.2	S 5 54.2	282 18.7	N 1 59.4	272 29.6	N 5 54.2	95 47.8	S 2 44.2
07	304 09.3	314 37.9	53.1	297 19.4	2 00.1	287 31.5	54.4	110 50.4	44.1
08	319 11.8	329 37.5	52.0	312 20.1	00.9	302 33.4	54.6	125 53.1	44.1
M 09	334 14.2	344 37.2	. . 50.9	327 20.8	. . 01.7	317 35.3	. . 54.9	140 55.7	. . 44.0
O 10	349 16.7	359 36.8	49.8	342 21.5	02.5	332 37.2	55.1	155 58.3	43.9
N 11	4 19.2	14 36.4	48.7	357 22.2	03.3	347 39.1	55.3	171 01.0	43.9
D 12	19 21.6	29 36.1	S 5 47.6	12 22.9	N 2 04.0	2 41.0	N 5 55.5	186 03.6	S 2 43.8
A 13	34 24.1	44 35.7	46.5	27 23.5	04.8	17 43.0	55.8	201 06.3	43.7
Y 14	49 26.6	59 35.4	45.4	42 24.2	05.6	32 44.9	56.0	216 08.9	43.6
15	64 29.0	74 35.0	. . 44.3	57 24.9	. . 06.4	47 46.8	. . 56.2	231 11.5	. . 43.6
16	79 31.5	89 34.7	43.2	72 25.6	07.2	62 48.7	56.5	246 14.2	43.5
17	94 34.0	104 34.3	42.0	87 26.3	07.9	77 50.6	56.7	261 16.8	43.4
18	109 36.4	119 34.0	S 5 40.9	102 27.0	N 2 08.7	92 52.5	N 5 56.9	276 19.5	S 2 43.3
19	124 38.9	134 33.6	39.8	117 27.7	09.5	107 54.4	57.2	291 22.1	43.3
20	139 41.4	149 33.2	38.7	132 28.4	10.3	122 56.3	57.4	306 24.8	43.2
21	154 43.8	164 32.9	. . 37.6	147 29.1	. . 11.0	137 58.2	. . 57.6	321 27.4	. . 43.1
22	169 46.3	179 32.5	36.5	162 29.8	11.8	153 00.1	57.8	336 30.0	43.1
23	184 48.7	194 32.2	35.4	177 30.5	12.6	168 02.0	58.1	351 32.7	43.0
12 00	199 51.2	209 31.8	S 5 34.3	192 31.2	N 2 13.4	183 03.9	N 5 58.3	6 35.3	S 2 42.9
01	214 53.7	224 31.5	33.2	207 31.8	14.2	198 05.8	58.5	21 38.0	42.8
02	229 56.1	239 31.1	32.1	222 32.5	14.9	213 07.7	58.8	36 40.6	42.8
03	244 58.6	254 30.8	. . 30.9	237 33.2	. . 15.7	228 09.6	. . 59.0	51 43.2	. . 42.7
04	260 01.1	269 30.4	29.8	252 33.9	16.5	243 11.5	59.2	66 45.9	42.6
05	275 03.5	284 30.1	28.7	267 34.6	17.3	258 13.4	59.5	81 48.5	42.5
06	290 06.0	299 29.7	S 5 27.6	282 35.3	N 2 18.1	273 15.3	N 5 59.7	96 51.2	S 2 42.5
07	305 08.5	314 29.3	26.5	297 36.0	18.8	288 17.2	5 59.9	111 53.8	42.4
08	320 10.9	329 29.0	25.4	312 36.7	19.6	303 19.1	6 00.1	126 56.4	42.3
T 09	335 13.4	344 28.6	. . 24.3	327 37.4	. . 20.4	318 21.0	. . 00.4	141 59.1	. . 42.3
U 10	350 15.9	359 28.3	23.2	342 38.1	21.2	333 22.9	00.6	157 01.7	42.2
E 11	5 18.3	14 27.9	22.0	357 38.8	22.0	348 24.8	00.8	172 04.4	42.1
S 12	20 20.8	29 27.6	S 5 20.9	12 39.4	N 2 22.7	3 26.7	N 6 01.1	187 07.0	S 2 42.0
D 13	35 23.2	44 27.2	19.8	27 40.1	23.5	18 28.6	01.3	202 09.6	42.0
A 14	50 25.7	59 26.9	18.7	42 40.8	24.3	33 30.5	01.5	217 12.3	41.9
Y 15	65 28.2	74 26.5	. . 17.6	57 41.5	. . 25.1	48 32.4	. . 01.8	232 14.9	. . 41.8
16	80 30.6	89 26.2	16.5	72 42.2	25.8	63 34.3	02.0	247 17.6	41.7
17	95 33.1	104 25.8	15.4	87 42.9	26.6	78 36.2	02.2	262 20.2	41.7
18	110 35.6	119 25.5	S 5 14.2	102 43.6	N 2 27.4	93 38.1	N 6 02.4	277 22.8	S 2 41.6
19	125 38.0	134 25.1	13.1	117 44.3	28.2	108 40.0	02.7	292 25.5	41.5
20	140 40.5	149 24.8	12.0	132 45.0	29.0	123 41.9	02.9	307 28.1	41.5
21	155 43.0	164 24.4	. . 10.9	147 45.7	. . 29.7	138 43.8	. . 03.1	322 30.8	. . 41.4
22	170 45.4	179 24.1	09.8	162 46.4	30.5	153 45.7	03.4	337 33.4	41.3
23	185 47.9	194 23.7	08.7	177 47.1	31.3	168 47.7	03.6	352 36.0	41.2
	h m								
Mer. Pass.	10 42.8	v −0.4	d 1.1	v 0.7	d 0.8	v 1.9	d 0.2	v 2.6	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.7
Achernar	335 28.4	S57 10.8
Acrux	173 10.5	S63 09.9
Adhara	255 13.8	S28 59.6
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.4	N55 53.8
Alkaid	152 59.6	N49 15.2
Al Na'ir	27 45.9	S46 54.2
Alnilam	275 48.1	S 1 11.9
Alphard	217 57.5	S 8 42.7
Alphecca	126 12.0	N26 40.4
Alpheratz	357 45.5	N29 09.1
Altair	62 09.8	N 8 53.8
Ankaa	353 17.6	S42 14.6
Antares	112 27.9	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 30.9	S69 02.7
Avior	234 18.6	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.1	N 7 24.4
Canopus	263 57.0	S52 42.5
Capella	280 37.0	N46 00.6
Deneb	49 32.7	N45 19.0
Denebola	182 34.9	N14 30.3
Diphda	348 57.8	S17 55.5
Dubhe	193 52.9	N61 41.4
Elnath	278 14.8	N28 37.0
Eltanin	90 46.7	N51 29.0
Enif	33 48.8	N 9 55.5
Fomalhaut	15 25.9	S29 33.6
Gacrux	172 02.2	S57 10.8
Gienah	175 53.6	S17 36.5
Hadar	148 49.6	S60 25.7
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.8	S34 22.6
Kochab	137 18.7	N74 06.3
Markab	13 40.2	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.1	S36 25.7
Miaplacidus	221 39.7	S69 46.2
Mirfak	308 43.1	N49 54.1
Nunki	76 00.2	S26 16.9
Peacock	53 21.8	S56 41.6
Pollux	243 29.6	N27 59.9
Procyon	245 01.4	N 5 11.6
Rasalhague	96 07.7	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.7	S 8 11.5
Rigil Kent.	139 53.3	S60 52.9
Sabik	102 14.1	S15 44.4
Schedar	349 43.0	N56 35.9
Shaula	96 23.8	S37 06.6
Sirius	258 35.2	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.5	S43 29.1
Vega	80 39.9	N38 47.4
Zuben'ubi	137 06.9	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	10 48.3	10 02
Mars	353 22.5	11 11
Jupiter	343 26.1	11 49
Saturn	166 39.9	23 34

UT	SUN			MOON						Lat.	Twilight		Sunrise	Moonrise			
	GHA		Dec	GHA	v	Dec	d	HP		Naut.	Civil		10	11	12	13
d h	° ′		° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
10 00	179 36.9	N	7 44.3	106 09.6	8.7	N22 54.0	3.3	56.5	N 72	////	02 35	04 04			08 38	11 21
01	194 37.1		45.3	120 37.3	8.7	22 50.7	3.4	56.6	N 70	////	03 03	04 17			09 26	11 42
02	209 37.2		46.2	135 05.0	8.7	22 47.3	3.5	56.6	68	01 37	03 23	04 28		07 47	09 56	11 57
03	224 37.4	. .	47.1	149 32.7	8.6	22 43.8	3.7	56.6	66	02 14	03 39	04 37	06 39	08 28	10 19	12 10
04	239 37.6		48.0	164 00.3	8.7	22 40.1	3.8	56.7	64	02 39	03 52	04 45	07 22	08 55	10 37	12 20
05	254 37.7		49.0	178 28.0	8.7	22 36.3	3.9	56.7	62	02 58	04 03	04 51	07 51	09 17	10 51	12 29
06	269 37.9	N	7 49.9	192 55.7	8.6	N22 32.4	4.1	56.7	60	03 13	04 12	04 57	08 12	09 34	11 03	12 37
07	284 38.1		50.8	207 23.3	8.7	22 28.3	4.2	56.8	N 58	03 26	04 20	05 01	08 30	09 48	11 14	12 44
08	299 38.3		51.7	221 51.0	8.6	22 24.1	4.3	56.8	56	03 37	04 26	05 06	08 45	10 00	11 23	12 49
S 09	314 38.4	. .	52.7	236 18.6	8.7	22 19.8	4.4	56.8	54	03 46	04 33	05 10	08 58	10 11	11 31	12 55
U 10	329 38.6		53.6	250 46.3	8.6	22 15.4	4.6	56.8	52	03 55	04 38	05 13	09 09	10 21	11 38	12 59
N 11	344 38.8		54.5	265 13.9	8.7	22 10.8	4.7	56.9	50	04 02	04 43	05 16	09 19	10 29	11 45	13 04
D 12	359 38.9	N	7 55.4	279 41.6	8.7	N22 06.1	4.8	56.9	45	04 17	04 53	05 23	09 40	10 47	11 58	13 13
A 13	14 39.1		56.4	294 09.3	8.6	22 01.3	5.0	56.9	N 40	04 28	05 01	05 29	09 57	11 02	12 10	13 20
Y 14	29 39.3		57.3	308 36.9	8.7	21 56.3	5.1	57.0	35	04 38	05 08	05 34	10 11	11 14	12 19	13 27
15	44 39.4	. .	58.2	323 04.6	8.7	21 51.2	5.2	57.0	30	04 45	05 14	05 38	10 24	11 25	12 28	13 33
16	59 39.6	7	59.1	337 32.3	8.6	21 46.0	5.3	57.0	20	04 57	05 23	05 46	10 45	11 43	12 42	13 43
17	74 39.8	8	00.1	351 59.9	8.7	21 40.7	5.5	57.1	N 10	05 06	05 31	05 52	11 03	11 59	12 55	13 51
18	89 39.9	N 8	01.0	6 27.6	8.7	N21 35.2	5.6	57.1	0	05 13	05 37	05 58	11 20	12 14	13 07	13 59
19	104 40.1		01.9	20 55.3	8.7	21 29.6	5.7	57.1	S 10	05 18	05 42	06 04	11 37	12 29	13 19	14 07
20	119 40.3		02.8	35 23.0	8.7	21 23.9	5.8	57.2	20	05 22	05 47	06 10	11 56	12 45	13 31	14 16
21	134 40.4	. .	03.8	49 50.7	8.7	21 18.1	6.0	57.2	30	05 25	05 52	06 16	12 17	13 03	13 46	14 26
22	149 40.6		04.7	64 18.4	8.7	21 12.1	6.1	57.2	35	05 25	05 55	06 20	12 29	13 13	13 54	14 31
23	164 40.8		05.6	78 46.1	8.7	21 06.0	6.2	57.3	40	05 26	05 57	06 25	12 43	13 25	14 03	14 37
									45	05 26	06 00	06 30	13 00	13 40	14 14	14 45
11 00	179 40.9	N 8	06.5	93 13.8	8.8	N20 59.8	6.4	57.3	S 50	05 25	06 03	06 35	13 20	13 57	14 27	14 54
01	194 41.1		07.4	107 41.6	8.7	20 53.4	6.4	57.3	52	05 25	06 04	06 38	13 30	14 05	14 34	14 58
02	209 41.3		08.4	122 09.3	8.8	20 47.0	6.6	57.4	54	05 25	06 06	06 41	13 41	14 14	14 40	15 02
03	224 41.4	. .	09.3	136 37.1	8.7	20 40.4	6.7	57.4	56	05 24	06 07	06 44	13 53	14 24	14 48	15 07
04	239 41.6		10.2	151 04.8	8.8	20 33.7	6.9	57.4	58	05 23	06 08	06 48	14 08	14 36	14 56	15 12
05	254 41.8		11.1	165 32.6	8.8	20 26.8	6.9	57.5	S 60	05 22	06 10	06 52	14 24	14 49	15 06	15 18
06	269 41.9	N 8	12.1	180 00.4	8.8	N20 19.9	7.1	57.5								
07	284 42.1		13.0	194 28.2	8.8	20 12.8	7.2	57.5	Lat.	Sunset	Twilight		Moonset			
08	299 42.3		13.9	208 56.0	8.8	20 05.6	7.3	57.6			Civil	Naut.	10	11	12	13
M 09	314 42.4	. .	14.8	223 23.8	8.9	19 58.3	7.5	57.6								
O 10	329 42.6		15.7	237 51.7	8.8	19 50.8	7.6	57.6	°	h m	h m	h m	h m	h m	h m	h m
N 11	344 42.8		16.7	252 19.5	8.9	19 43.2	7.6	57.7	N 72	20 02	21 33	////			05 27	04 34
D 12	359 42.9	N 8	17.6	266 47.4	8.9	N19 35.6	7.9	57.7	N 70	19 48	21 04	////			04 38	04 12
A 13	14 43.1		18.5	281 15.3	8.9	19 27.7	7.9	57.7	68	19 37	20 43	22 34		04 24	04 06	03 55
Y 14	29 43.2		19.4	295 43.2	8.9	19 19.8	8.0	57.8	66	19 27	20 26	21 54	03 39	03 43	03 42	03 40
15	44 43.4	. .	20.3	310 11.1	8.9	19 11.8	8.2	57.8	64	19 20	20 13	21 27	02 56	03 14	03 24	03 29
16	59 43.6		21.2	324 39.0	8.9	19 03.6	8.3	57.8	62	19 13	20 02	21 07	02 27	02 53	03 08	03 18
17	74 43.7		22.2	339 06.9	9.0	18 55.3	8.3	57.9	60	19 07	19 53	20 51	02 05	02 35	02 55	03 10
18	89 43.9	N 8	23.1	353 34.9	8.9	N18 47.0	8.6	57.9	N 58	19 02	19 44	20 38	01 47	02 20	02 44	03 02
19	104 44.1		24.0	8 02.8	9.0	18 38.4	8.6	57.9	56	18 58	19 37	20 27	01 32	02 07	02 34	02 55
20	119 44.2		24.9	22 30.8	9.0	18 29.8	8.7	58.0	54	18 54	19 31	20 18	01 19	01 56	02 26	02 49
21	134 44.4	. .	25.8	36 58.8	9.1	18 21.1	8.9	58.0	52	18 50	19 26	20 09	01 07	01 46	02 18	02 44
22	149 44.6		26.7	51 26.9	9.0	18 12.2	8.9	58.0	50	18 47	19 21	20 02	00 57	01 37	02 11	02 39
23	164 44.7		27.7	65 54.9	9.0	18 03.3	9.1	58.1	45	18 40	19 10	19 47	00 36	01 19	01 56	02 28
12 00	179 44.9	N 8	28.6	80 22.9	9.1	N17 54.2	9.2	58.1	N 40	18 34	19 02	19 35	00 18	01 03	01 43	02 19
01	194 45.1		29.5	94 51.0	9.1	17 45.0	9.3	58.2	35	18 29	18 55	19 25	00 04	00 50	01 33	02 11
02	209 45.2		30.4	109 19.1	9.1	17 35.7	9.4	58.2	30	18 25	18 49	19 18	24 39	00 39	01 23	02 04
03	224 45.4	. .	31.3	123 47.2	9.1	17 26.3	9.5	58.2	20	18 17	18 39	19 05	24 19	00 19	01 07	01 52
04	239 45.5		32.2	138 15.3	9.2	17 16.8	9.7	58.3	N 10	18 10	18 32	18 56	24 02	00 02	00 53	01 42
05	254 45.7		33.2	152 43.5	9.1	17 07.1	9.7	58.3	0	18 04	18 25	18 50	23 46	24 39	00 39	01 32
06	269 45.9	N 8	34.1	167 11.6	9.2	N16 57.4	9.9	58.3	S 10	17 59	18 20	18 44	23 30	24 26	00 26	01 22
07	284 46.0		35.0	181 39.8	9.2	16 47.5	9.9	58.4	20	17 52	18 15	18 40	23 13	24 11	00 11	01 11
T 08	299 46.2		35.9	196 08.0	9.2	16 37.6	10.1	58.4	30	17 45	18 10	18 37	22 52	23 55	24 59	00 59
U 09	314 46.4	. .	36.8	210 36.2	9.2	16 27.5	10.1	58.4	35	17 42	18 07	18 36	22 41	23 45	24 51	00 51
E 10	329 46.5		37.7	225 04.4	9.2	16 17.4	10.3	58.5	40	17 37	18 04	18 36	22 27	23 34	24 43	00 43
S 11	344 46.7		38.6	239 32.6	9.3	16 07.1	10.4	58.5	45	17 32	18 02	18 36	22 11	23 20	24 33	00 33
D 12	359 46.8	N 8	39.6	254 00.9	9.3	N15 56.7	10.5	58.5	S 50	17 26	17 58	18 36	21 51	23 04	24 22	00 22
A 13	14 47.0		40.5	268 29.2	9.2	15 46.2	10.5	58.6	52	17 23	17 57	18 36	21 42	22 56	24 16	00 16
Y 14	29 47.2		41.4	282 57.4	9.3	15 35.7	10.7	58.6	54	17 20	17 56	18 37	21 31	22 48	24 10	00 10
15	44 47.3	. .	42.3	297 25.7	9.4	15 25.0	10.8	58.7	56	17 17	17 54	18 37	21 19	22 38	24 03	00 03
16	59 47.5		43.2	311 54.1	9.3	15 14.2	10.9	58.7	58	17 13	17 53	18 38	21 05	22 27	23 56	25 27
17	74 47.7		44.1	326 22.4	9.4	15 03.3	11.0	58.7	S 60	17 09	17 51	18 39	20 49	22 15	23 47	25 22
18	89 47.8	N 8	45.0	340 50.8	9.3	N14 52.3	11.0	58.8			SUN			MOON		
19	104 48.0		45.9	355 19.1	9.4	14 41.3	11.2	58.8	Day	Eqn. of Time		Mer.	Mer. Pass.		Age	Phase
20	119 48.1		46.9	9 47.5	9.4	14 30.1	11.3	58.8		00^h	12^h	Pass.	Upper	Lower		
21	134 48.3	. .	47.8	24 15.9	9.4	14 18.8	11.3	58.9	d	m s	m s	h m	h m	h m	d %	
22	149 48.5		48.7	38 44.3	9.4	14 07.5	11.5	58.9	10	01 33	01 25	12 01	17 33	05 06	07 40	
23	164 48.6		49.6	53 12.7	9.5	N13 56.0	11.5	58.9	11	01 17	01 09	12 01	18 27	06 00	08 50	
	SD 16.0	d	0.9	SD 15.5		15.7		16.0	12	01 01	00 53	12 01	19 19	06 53	09 61	

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
13 00	200 50.4	209 23.4	S 5 07.5	192 47.8	N 2 32.1	183 49.6	N 6 03.8	7 38.7	S 2 41.2
01	215 52.8	224 23.0	06.4	207 48.4	32.8	198 51.5	04.1	22 41.3	41.1
02	230 55.3	239 22.7	05.3	222 49.1	33.6	213 53.4	04.3	37 44.0	41.0
03	245 57.7	254 22.3	04.2	237 49.8	34.4	228 55.3	04.5	52 46.6	40.9
04	261 00.2	269 22.0	03.1	252 50.5	35.2	243 57.2	04.7	67 49.2	40.9
05	276 02.7	284 21.6	01.9	267 51.2	35.9	258 59.1	05.0	82 51.9	40.8
06	291 05.1	299 21.3	S 5 00.8	282 51.9	N 2 36.7	274 01.0	N 6 05.2	97 54.5	S 2 40.7
W 07	306 07.6	314 20.9	4 59.7	297 52.6	37.5	289 02.9	05.4	112 57.2	40.7
E 08	321 10.1	329 20.6	58.6	312 53.3	38.3	304 04.8	05.7	127 59.8	40.6
D 09	336 12.5	344 20.2	57.5	327 54.0	39.1	319 06.7	05.9	143 02.4	40.5
N 10	351 15.0	359 19.9	56.3	342 54.7	39.8	334 08.6	06.1	158 05.1	40.4
E 11	6 17.5	14 19.5	55.2	357 55.4	40.6	349 10.5	06.3	173 07.7	40.4
S 12	21 19.9	29 19.2	S 4 54.1	12 56.1	N 2 41.4	4 12.4	N 6 06.6	188 10.4	S 2 40.3
D 13	36 22.4	44 18.8	53.0	27 56.7	42.2	19 14.3	06.8	203 13.0	40.2
A 14	51 24.8	59 18.5	51.9	42 57.4	42.9	34 16.2	07.0	218 15.6	40.1
Y 15	66 27.3	74 18.1	50.7	57 58.1	43.7	49 18.1	07.3	233 18.3	40.1
16	81 29.8	89 17.8	49.6	72 58.8	44.5	64 20.0	07.5	248 20.9	40.0
17	96 32.2	104 17.4	48.5	87 59.5	45.3	79 21.9	07.7	263 23.6	39.9
18	111 34.7	119 17.1	S 4 47.4	103 00.2	N 2 46.0	94 23.8	N 6 07.9	278 26.2	S 2 39.9
19	126 37.2	134 16.7	46.3	118 00.9	46.8	109 25.7	08.2	293 28.8	39.8
20	141 39.6	149 16.4	45.1	133 01.6	47.6	124 27.6	08.4	308 31.5	39.7
21	156 42.1	164 16.0	44.0	148 02.3	48.4	139 29.5	08.6	323 34.1	39.6
22	171 44.6	179 15.7	42.9	163 03.0	49.1	154 31.4	08.9	338 36.8	39.6
23	186 47.0	194 15.4	41.8	178 03.7	49.9	169 33.3	09.1	353 39.4	39.5
14 00	201 49.5	209 15.0	S 4 40.6	193 04.4	N 2 50.7	184 35.2	N 6 09.3	8 42.0	S 2 39.4
01	216 52.0	224 14.7	39.5	208 05.1	51.5	199 37.1	09.6	23 44.7	39.4
02	231 54.4	239 14.3	38.4	223 05.8	52.2	214 39.0	09.8	38 47.3	39.3
03	246 56.9	254 14.0	37.3	238 06.4	53.0	229 40.9	10.0	53 49.9	39.2
04	261 59.3	269 13.6	36.1	253 07.1	53.8	244 42.8	10.2	68 52.6	39.1
05	277 01.8	284 13.3	35.0	268 07.8	54.6	259 44.7	10.5	83 55.2	39.1
06	292 04.3	299 12.9	S 4 33.9	283 08.5	N 2 55.4	274 46.7	N 6 10.7	98 57.9	S 2 39.0
07	307 06.7	314 12.6	32.8	298 09.2	56.1	289 48.6	10.9	114 00.5	38.9
T 08	322 09.2	329 12.2	31.6	313 09.9	56.9	304 50.5	11.2	129 03.1	38.9
H 09	337 11.7	344 11.9	30.5	328 10.6	57.7	319 52.4	11.4	144 05.8	38.8
U 10	352 14.1	359 11.6	29.4	343 11.3	58.5	334 54.3	11.6	159 08.4	38.7
R 11	7 16.6	14 11.2	28.3	358 12.0	2 59.2	349 56.2	11.8	174 11.1	38.6
S 12	22 19.1	29 10.9	S 4 27.1	13 12.7	N 3 00.0	4 58.1	N 6 12.1	189 13.7	S 2 38.6
D 13	37 21.5	44 10.5	26.0	28 13.4	00.8	20 00.0	12.3	204 16.3	38.5
A 14	52 24.0	59 10.2	24.9	43 14.1	01.5	35 01.9	12.5	219 19.0	38.4
Y 15	67 26.4	74 09.8	23.7	58 14.8	02.3	50 03.8	12.8	234 21.6	38.4
16	82 28.9	89 09.5	22.6	73 15.4	03.1	65 05.7	13.0	249 24.3	38.3
17	97 31.4	104 09.1	21.5	88 16.1	03.9	80 07.6	13.2	264 26.9	38.2
18	112 33.8	119 08.8	S 4 20.4	103 16.8	N 3 04.6	95 09.5	N 6 13.4	279 29.5	S 2 38.1
19	127 36.3	134 08.5	19.2	118 17.5	05.4	110 11.4	13.7	294 32.2	38.1
20	142 38.8	149 08.1	18.1	133 18.2	06.2	125 13.3	13.9	309 34.8	38.0
21	157 41.2	164 07.8	17.0	148 18.9	07.0	140 15.2	14.1	324 37.4	37.9
22	172 43.7	179 07.4	15.8	163 19.6	07.7	155 17.1	14.4	339 40.1	37.9
23	187 46.2	194 07.1	14.7	178 20.3	08.5	170 19.0	14.6	354 42.7	37.8
15 00	202 48.6	209 06.7	S 4 13.6	193 21.0	N 3 09.3	185 20.9	N 6 14.8	9 45.4	S 2 37.7
01	217 51.1	224 06.4	12.5	208 21.7	10.1	200 22.8	15.0	24 48.0	37.6
02	232 53.6	239 06.1	11.3	223 22.4	10.8	215 24.7	15.3	39 50.6	37.6
03	247 56.0	254 05.7	10.2	238 23.1	11.6	230 26.6	15.5	54 53.3	37.5
04	262 58.5	269 05.4	09.1	253 23.8	12.4	245 28.5	15.7	69 55.9	37.4
05	278 00.9	284 05.0	07.9	268 24.5	13.2	260 30.4	16.0	84 58.5	37.4
06	293 03.4	299 04.7	S 4 06.8	283 25.1	N 3 13.9	275 32.3	N 6 16.2	100 01.2	S 2 37.3
07	308 05.9	314 04.3	05.7	298 25.8	14.7	290 34.2	16.4	115 03.8	37.2
08	323 08.3	329 04.0	04.5	313 26.5	15.5	305 36.1	16.6	130 06.5	37.1
F 09	338 10.8	344 03.7	03.4	328 27.2	16.2	320 38.0	16.9	145 09.1	37.1
R 10	353 13.3	359 03.3	02.3	343 27.9	17.0	335 39.9	17.1	160 11.7	37.0
I 11	8 15.7	14 03.0	01.1	358 28.6	17.8	350 41.9	17.3	175 14.4	36.9
D 12	23 18.2	29 02.6	S 4 00.0	13 29.3	N 3 18.6	5 43.8	N 6 17.6	190 17.0	S 2 36.9
A 13	38 20.7	44 02.3	3 58.9	28 30.0	19.3	20 45.7	17.8	205 19.7	36.8
Y 14	53 23.1	59 02.0	57.7	43 30.7	20.1	35 47.6	18.0	220 22.3	36.7
15	68 25.6	74 01.6	56.6	58 31.4	20.9	50 49.5	18.2	235 24.9	36.6
16	83 28.1	89 01.3	55.5	73 32.1	21.7	65 51.4	18.5	250 27.6	36.6
17	98 30.5	104 00.9	54.3	88 32.8	22.4	80 53.3	18.7	265 30.2	36.5
18	113 33.0	119 00.6	S 3 53.2	103 33.5	N 3 23.2	95 55.2	N 6 18.9	280 32.8	S 2 36.4
19	128 35.4	134 00.3	52.1	118 34.2	24.0	110 57.1	19.1	295 35.5	36.4
20	143 37.9	148 59.9	50.9	133 34.9	24.7	125 59.0	19.4	310 38.1	36.3
21	158 40.4	163 59.6	49.8	148 35.5	25.5	141 00.9	19.6	325 40.8	36.2
22	173 42.8	178 59.2	48.7	163 36.2	26.3	156 02.8	19.8	340 43.4	36.1
23	188 45.3	193 58.9	47.5	178 36.9	27.1	171 04.7	20.1	355 46.0	36.1
	h m								
Mer. Pass.	10 31.0	v −0.3	d 1.1	v 0.7	d 0.8	v 1.9	d 0.2	v 2.6	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.7
Achernar	335 28.4	S57 10.7
Acrux	173 10.5	S63 10.0
Adhara	255 13.8	S28 59.6
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.4	N55 53.8
Alkaid	152 59.6	N49 15.2
Al Na'ir	27 45.9	S46 54.2
Alnilam	275 48.1	S 1 11.8
Alphard	217 57.5	S 8 42.7
Alphecca	126 12.0	N26 40.4
Alpheratz	357 45.5	N29 09.1
Altair	62 09.8	N 8 53.8
Ankaa	353 17.6	S42 14.6
Antares	112 27.9	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 30.8	S69 02.7
Avior	234 18.6	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.1	N 7 24.4
Canopus	263 57.0	S52 42.5
Capella	280 37.0	N46 00.6
Deneb	49 32.7	N45 19.0
Denebola	182 34.9	N14 30.3
Diphda	348 57.7	S17 55.5
Dubhe	193 52.9	N61 41.4
Elnath	278 14.8	N28 37.0
Eltanin	90 46.6	N51 29.0
Enif	33 48.8	N 9 55.6
Fomalhaut	15 25.9	S29 33.6
Gacrux	172 02.2	S57 10.8
Gienah	175 53.6	S17 36.5
Hadar	148 49.6	S60 25.7
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.7	S34 22.6
Kochab	137 18.7	N74 06.4
Markab	13 40.2	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.1	S36 25.7
Miaplacidus	221 39.8	S69 46.2
Mirfak	308 43.1	N49 54.1
Nunki	76 00.2	S26 16.9
Peacock	53 21.7	S56 41.6
Pollux	243 29.6	N27 59.9
Procyon	245 01.4	N 5 11.6
Rasalhague	96 07.7	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.7	S 8 11.5
Rigil Kent.	139 53.3	S60 52.9
Sabik	102 14.1	S15 44.4
Schedar	349 43.0	N56 35.9
Shaula	96 23.8	S37 06.6
Sirius	258 35.2	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.5	S43 29.1
Vega	80 39.9	N38 47.4
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	7 25.5	10 03
Mars	351 14.9	11 07
Jupiter	342 45.7	11 40
Saturn	166 52.5	23 21

UT	SUN			MOON					
	GHA		Dec	GHA	v		Dec	d	HP
d h	° ′		° ′	° ′	′		° ′	′	′
13 00	179 48.8	N	8 50.5	67 41.2	9.4	N	13 44.5	11.7	59.0
01	194 48.9		51.4	82 09.6	9.5		13 32.8	11.7	59.0
02	209 49.1		52.3	96 38.1	9.5		13 21.1	11.8	59.0
03	224 49.3	. .	53.2	111 06.6	9.5		13 09.3	11.9	59.1
04	239 49.4		54.1	125 35.1	9.5		12 57.4	12.0	59.1
05	254 49.6		55.0	140 03.6	9.5		12 45.4	12.1	59.1
06	269 49.7	N	8 56.0	154 32.1	9.5	N	12 33.3	12.2	59.2
W 07	284 49.9		56.9	169 00.6	9.6		12 21.1	12.3	59.2
E 08	299 50.1		57.8	183 29.2	9.5		12 08.8	12.3	59.2
D 09	314 50.2	. .	58.7	197 57.7	9.6		11 56.5	12.4	59.3
N 10	329 50.4		8 59.6	212 26.3	9.6		11 44.1	12.5	59.3
E 11	344 50.5		9 00.5	226 54.9	9.6		11 31.6	12.6	59.4
S 12	359 50.7	N	9 01.4	241 23.5	9.6	N	11 19.0	12.7	59.4
D 13	14 50.9		02.3	255 52.1	9.6		11 06.3	12.7	59.4
A 14	29 51.0		03.2	270 20.7	9.6		10 53.6	12.8	59.5
Y 15	44 51.2	. .	04.1	284 49.3	9.6		10 40.8	12.9	59.5
16	59 51.3		05.0	299 17.9	9.6		10 27.9	13.0	59.5
17	74 51.5		05.9	313 46.5	9.6		10 14.9	13.0	59.6
18	89 51.7	N	9 06.8	328 15.1	9.7	N	10 01.9	13.1	59.6
19	104 51.8		07.7	342 43.8	9.6		9 48.8	13.2	59.6
20	119 52.0		08.6	357 12.4	9.6		9 35.6	13.3	59.7
21	134 52.1	. .	09.5	11 41.0	9.7		9 22.3	13.3	59.7
22	149 52.3		10.5	26 09.7	9.6		9 09.0	13.4	59.7
23	164 52.4		11.4	40 38.3	9.7		8 55.6	13.5	59.8
14 00	179 52.6	N	9 12.3	55 07.0	9.6	N	8 42.1	13.5	59.8
01	194 52.8		13.2	69 35.6	9.7		8 28.6	13.6	59.8
02	209 52.9		14.1	84 04.3	9.7		8 15.0	13.6	59.8
03	224 53.1	. .	15.0	98 33.0	9.6		8 01.4	13.7	59.9
04	239 53.2		15.9	113 01.6	9.7		7 47.7	13.8	59.9
05	254 53.4		16.8	127 30.3	9.6		7 33.9	13.8	59.9
06	269 53.5	N	9 17.7	141 58.9	9.7	N	7 20.1	13.9	60.0
T 07	284 53.7		18.6	156 27.6	9.6		7 06.2	14.0	60.0
H 08	299 53.9		19.5	170 56.2	9.7		6 52.2	14.0	60.0
U 09	314 54.0	. .	20.4	185 24.9	9.6		6 38.2	14.0	60.1
R 10	329 54.2		21.3	199 53.5	9.6		6 24.2	14.1	60.1
S 11	344 54.3		22.2	214 22.1	9.7		6 10.1	14.2	60.1
D 12	359 54.5	N	9 23.1	228 50.8	9.6	N	5 55.9	14.2	60.2
A 13	14 54.6		24.0	243 19.4	9.6		5 41.7	14.2	60.2
Y 14	29 54.8		24.9	257 48.0	9.6		5 27.5	14.3	60.2
15	44 54.9	. .	25.8	272 16.6	9.6		5 13.2	14.3	60.2
16	59 55.1		26.7	286 45.2	9.6		4 58.9	14.4	60.3
17	74 55.3		27.6	301 13.8	9.6		4 44.5	14.4	60.3
18	89 55.4	N	9 28.5	315 42.4	9.6	N	4 30.1	14.5	60.3
19	104 55.6		29.4	330 11.0	9.5		4 15.6	14.5	60.4
20	119 55.7		30.3	344 39.5	9.6		4 01.1	14.5	60.4
21	134 55.9	. .	31.2	359 08.1	9.5		3 46.6	14.6	60.4
22	149 56.0		32.1	13 36.6	9.5		3 32.0	14.6	60.4
23	164 56.2		33.0	28 05.1	9.5		3 17.4	14.7	60.5
15 00	179 56.3	N	9 33.9	42 33.6	9.5	N	3 02.7	14.6	60.5
01	194 56.5		34.8	57 02.1	9.5		2 48.1	14.7	60.5
02	209 56.6		35.7	71 30.6	9.4		2 33.4	14.8	60.5
03	224 56.8	. .	36.6	85 59.0	9.4		2 18.6	14.7	60.6
04	239 57.0		37.5	100 27.4	9.5		2 03.9	14.8	60.6
05	254 57.1		38.4	114 55.9	9.4		1 49.1	14.8	60.6
06	269 57.3	N	9 39.2	129 24.3	9.3	N	1 34.3	14.8	60.6
07	284 57.4		40.1	143 52.6	9.4		1 19.5	14.9	60.7
08	299 57.6		41.0	158 21.0	9.3		1 04.6	14.8	60.7
F 09	314 57.7	. .	41.9	172 49.3	9.3		0 49.8	14.9	60.7
R 10	329 57.9		42.8	187 17.6	9.3		0 34.9	14.9	60.7
I 11	344 58.0		43.7	201 45.9	9.2		0 20.0	14.9	60.7
D 12	359 58.2	N	9 44.6	216 14.1	9.3	N	0 05.1	14.9	60.8
A 13	14 58.3		45.5	230 42.4	9.2	S	0 09.8	15.0	60.8
Y 14	29 58.5		46.4	245 10.6	9.1		0 24.8	14.9	60.8
15	44 58.6	. .	47.3	259 38.7	9.2		0 39.7	14.9	60.8
16	59 58.8		48.2	274 06.9	9.1		0 54.6	15.0	60.9
17	74 58.9		49.1	288 35.0	9.1		1 09.6	14.9	60.9
18	89 59.1	N	9 50.0	303 03.1	9.1	S	1 24.5	15.0	60.9
19	104 59.2		50.9	317 31.2	9.0		1 39.5	14.9	60.9
20	119 59.4		51.8	331 59.2	9.0		1 54.4	15.0	60.9
21	134 59.5	. .	52.6	346 27.2	8.9		2 09.4	14.9	60.9
22	149 59.7		53.5	0 55.1	9.0		2 24.3	15.0	61.0
23	164 59.8		54.4	15 23.1	8.9	S	2 39.3	14.9	61.0
	SD 16.0		d 0.9	SD 16.2			16.4		16.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 13	Moonrise 14	Moonrise 15	Moonrise 16
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	02 11	03 47	11 21	13 41	15 57	18 17
N 70	////	02 44	04 03	11 42	13 49	15 55	18 05
68	01 02	03 07	04 15	11 57	13 56	15 54	17 55
66	01 52	03 25	04 25	12 10	14 01	15 53	17 48
64	02 22	03 40	04 34	12 20	14 05	15 52	17 41
62	02 44	03 52	04 41	12 29	14 09	15 51	17 35
60	03 02	04 02	04 48	12 37	14 13	15 51	17 31
N 58	03 16	04 11	04 53	12 44	14 16	15 50	17 26
56	03 28	04 18	04 58	12 49	14 18	15 50	17 23
54	03 38	04 25	05 03	12 55	14 21	15 49	17 19
52	03 47	04 31	05 07	12 59	14 23	15 49	17 16
50	03 55	04 36	05 10	13 04	14 25	15 48	17 13
45	04 11	04 47	05 18	13 13	14 29	15 47	17 07
N 40	04 23	04 57	05 24	13 20	14 33	15 47	17 02
35	04 33	05 04	05 30	13 27	14 36	15 46	16 58
30	04 42	05 10	05 35	13 33	14 39	15 46	16 54
20	04 55	05 21	05 43	13 43	14 43	15 45	16 48
N 10	05 04	05 29	05 50	13 51	14 47	15 44	16 42
0	05 12	05 36	05 57	13 59	14 51	15 44	16 37
S 10	05 18	05 42	06 04	14 07	14 55	15 43	16 32
20	05 23	05 48	06 10	14 16	14 59	15 42	16 27
30	05 26	05 54	06 18	14 26	15 04	15 42	16 21
35	05 28	05 57	06 23	14 31	15 07	15 41	16 17
40	05 29	06 00	06 28	14 37	15 10	15 41	16 13
45	05 30	06 04	06 33	14 45	15 13	15 41	16 09
S 50	05 30	06 07	06 40	14 54	15 17	15 40	16 03
52	05 30	06 09	06 43	14 58	15 19	15 40	16 01
54	05 30	06 11	06 47	15 02	15 21	15 39	15 58
56	05 30	06 13	06 50	15 07	15 23	15 39	15 55
58	05 29	06 15	06 55	15 12	15 26	15 39	15 52
S 60	05 29	06 17	06 59	15 18	15 29	15 38	15 49

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 13	Moonset 14	Moonset 15	Moonset 16
°	h m	h m	h m	h m	h m	h m	h m
N 72	20 17	21 57	////	04 34	04 05	03 42	03 19
N 70	20 01	21 22	////	04 12	03 54	03 39	03 24
68	19 48	20 57	23 14	03 55	03 45	03 37	03 29
66	19 38	20 39	22 15	03 40	03 38	03 35	03 32
64	19 29	20 24	21 43	03 29	03 31	03 34	03 35
62	19 21	20 11	21 20	03 18	03 26	03 32	03 38
60	19 15	20 01	21 02	03 10	03 21	03 31	03 41
N 58	19 09	19 52	20 47	03 02	03 17	03 30	03 43
56	19 04	19 44	20 35	02 55	03 13	03 29	03 45
54	18 59	19 37	20 25	02 49	03 10	03 28	03 46
52	18 55	19 31	20 16	02 44	03 06	03 27	03 48
50	18 52	19 26	20 08	02 39	03 04	03 26	03 49
45	18 44	19 14	19 51	02 28	02 57	03 25	03 52
N 40	18 37	19 05	19 39	02 19	02 52	03 23	03 55
35	18 31	18 57	19 28	02 11	02 47	03 22	03 57
30	18 26	18 51	19 20	02 04	02 43	03 21	03 59
20	18 18	18 40	19 07	01 52	02 36	03 19	04 03
N 10	18 10	18 32	18 57	01 42	02 30	03 18	04 06
0	18 04	18 25	18 49	01 32	02 24	03 16	04 09
S 10	17 57	18 18	18 43	01 22	02 18	03 14	04 12
20	17 50	18 12	18 38	01 11	02 11	03 12	04 15
30	17 42	18 06	18 34	00 59	02 04	03 10	04 18
35	17 38	18 03	18 33	00 51	02 00	03 09	04 20
40	17 33	18 00	18 31	00 43	01 55	03 08	04 23
45	17 27	17 56	18 30	00 33	01 49	03 06	04 25
S 50	17 20	17 53	18 30	00 22	01 42	03 04	04 28
52	17 17	17 51	18 30	00 16	01 39	03 03	04 30
54	17 13	17 49	18 30	00 10	01 35	03 02	04 31
56	17 09	17 47	18 30	00 03	01 31	03 01	04 33
58	17 05	17 45	18 30	25 27	01 27	03 00	04 35
S 60	17 00	17 43	18 31	25 22	01 22	02 59	04 37

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
13	00 45	00 38	12 01	20 12	07 46	10	72
14	00 30	00 22	12 00	21 04	08 38	11	81
15	00 15	00 08	12 00	21 56	09 30	12	90

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.4	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
16 00	203 47.8	208 58.6	S 3 46.4	193 37.6	N 3 27.8	186 06.6	N 6 20.3	10 48.7	S 2 36.0
01	218 50.2	223 58.2	45.3	208 38.3	28.6	201 08.5	20.5	25 51.3	35.9
02	233 52.7	238 57.9	44.1	223 39.0	29.4	216 10.4	20.7	40 53.9	35.9
03	248 55.2	253 57.5	. . 43.0	238 39.7	. . 30.1	231 12.3	. . 21.0	55 56.6	. . 35.8
04	263 57.6	268 57.2	41.8	253 40.4	30.9	246 14.2	21.2	70 59.2	35.7
05	279 00.1	283 56.9	40.7	268 41.1	31.7	261 16.1	21.4	86 01.8	35.7
06	294 02.5	298 56.5	S 3 39.6	283 41.8	N 3 32.5	276 18.0	N 6 21.7	101 04.5	S 2 35.6
07	309 05.0	313 56.2	38.4	298 42.5	33.2	291 19.9	21.9	116 07.1	35.5
S 08	324 07.5	328 55.8	37.3	313 43.2	34.0	306 21.8	22.1	131 09.8	35.4
A 09	339 09.9	343 55.5	. . 36.2	328 43.9	. . 34.8	321 23.7	. . 22.3	146 12.4	. . 35.4
T 10	354 12.4	358 55.2	35.0	343 44.6	35.5	336 25.6	22.6	161 15.0	35.3
U 11	9 14.9	13 54.8	33.9	358 45.2	36.3	351 27.5	22.8	176 17.7	35.2
R 12	24 17.3	28 54.5	S 3 32.7	13 45.9	N 3 37.1	6 29.4	N 6 23.0	191 20.3	S 2 35.2
D 13	39 19.8	43 54.1	31.6	28 46.6	37.9	21 31.3	23.2	206 22.9	35.1
A 14	54 22.3	58 53.8	30.5	43 47.3	38.6	36 33.2	23.5	221 25.6	35.0
Y 15	69 24.7	73 53.5	. . 29.3	58 48.0	. . 39.4	51 35.2	. . 23.7	236 28.2	. . 35.0
16	84 27.2	88 53.1	28.2	73 48.7	40.2	66 37.1	23.9	251 30.9	34.9
17	99 29.7	103 52.8	27.0	88 49.4	40.9	81 39.0	24.2	266 33.5	34.8
18	114 32.1	118 52.5	S 3 25.9	103 50.1	N 3 41.7	96 40.9	N 6 24.4	281 36.1	S 2 34.7
19	129 34.6	133 52.1	24.8	118 50.8	42.5	111 42.8	24.6	296 38.8	34.7
20	144 37.0	148 51.8	23.6	133 51.5	43.2	126 44.7	24.8	311 41.4	34.6
21	159 39.5	163 51.4	. . 22.5	148 52.2	. . 44.0	141 46.6	. . 25.1	326 44.0	. . 34.5
22	174 42.0	178 51.1	21.3	163 52.9	44.8	156 48.5	25.3	341 46.7	34.5
23	189 44.4	193 50.8	20.2	178 53.6	45.6	171 50.4	25.5	356 49.3	34.4
17 00	204 46.9	208 50.4	S 3 19.1	193 54.3	N 3 46.3	186 52.3	N 6 25.7	11 51.9	S 2 34.3
01	219 49.4	223 50.1	17.9	208 55.0	47.1	201 54.2	26.0	26 54.6	34.3
02	234 51.8	238 49.8	16.8	223 55.7	47.9	216 56.1	26.2	41 57.2	34.2
03	249 54.3	253 49.4	. . 15.6	238 56.3	. . 48.6	231 58.0	. . 26.4	56 59.9	. . 34.1
04	264 56.8	268 49.1	14.5	253 57.0	49.4	246 59.9	26.7	72 02.5	34.0
05	279 59.2	283 48.8	13.4	268 57.7	50.2	262 01.8	26.9	87 05.1	34.0
06	295 01.7	298 48.4	S 3 12.2	283 58.4	N 3 50.9	277 03.7	N 6 27.1	102 07.8	S 2 33.9
07	310 04.1	313 48.1	11.1	298 59.1	51.7	292 05.6	27.3	117 10.4	33.8
08	325 06.6	328 47.7	09.9	313 59.8	52.5	307 07.5	27.6	132 13.0	33.8
S 09	340 09.1	343 47.4	. . 08.8	329 00.5	. . 53.2	322 09.4	. . 27.8	147 15.7	. . 33.7
U 10	355 11.5	358 47.1	07.6	344 01.2	54.0	337 11.3	28.0	162 18.3	33.6
N 11	10 14.0	13 46.7	06.5	359 01.9	54.8	352 13.2	28.2	177 20.9	33.6
D 12	25 16.5	28 46.4	S 3 05.4	14 02.6	N 3 55.6	7 15.1	N 6 28.5	192 23.6	S 2 33.5
A 13	40 18.9	43 46.1	04.2	29 03.3	56.3	22 17.0	28.7	207 26.2	33.4
Y 14	55 21.4	58 45.7	03.1	44 04.0	57.1	37 18.9	28.9	222 28.8	33.3
15	70 23.9	73 45.4	. . 01.9	59 04.7	. . 57.9	52 20.8	. . 29.2	237 31.5	. . 33.3
16	85 26.3	88 45.1	3 00.8	74 05.4	58.6	67 22.8	29.4	252 34.1	33.2
17	100 28.8	103 44.7	2 59.6	89 06.1	3 59.4	82 24.7	29.6	267 36.7	33.1
18	115 31.3	118 44.4	S 2 58.5	104 06.7	N 4 00.2	97 26.6	N 6 29.8	282 39.4	S 2 33.1
19	130 33.7	133 44.1	57.4	119 07.4	00.9	112 28.5	30.1	297 42.0	33.0
20	145 36.2	148 43.7	56.2	134 08.1	01.7	127 30.4	30.3	312 44.7	32.9
21	160 38.6	163 43.4	. . 55.1	149 08.8	. . 02.5	142 32.3	. . 30.5	327 47.3	. . 32.9
22	175 41.1	178 43.0	53.9	164 09.5	03.2	157 34.2	30.7	342 49.9	32.8
23	190 43.6	193 42.7	52.8	179 10.2	04.0	172 36.1	31.0	357 52.6	32.7
18 00	205 46.0	208 42.4	S 2 51.6	194 10.9	N 4 04.8	187 38.0	N 6 31.2	12 55.2	S 2 32.7
01	220 48.5	223 42.0	50.5	209 11.6	05.5	202 39.9	31.4	27 57.8	32.6
02	235 51.0	238 41.7	49.3	224 12.3	06.3	217 41.8	31.7	43 00.5	32.5
03	250 53.4	253 41.4	. . 48.2	239 13.0	. . 07.1	232 43.7	. . 31.9	58 03.1	. . 32.4
04	265 55.9	268 41.0	47.0	254 13.7	07.8	247 45.6	32.1	73 05.7	32.4
05	280 58.4	283 40.7	45.9	269 14.4	08.6	262 47.5	32.3	88 08.4	32.3
06	296 00.8	298 40.4	S 2 44.8	284 15.1	N 4 09.4	277 49.4	N 6 32.6	103 11.0	S 2 32.2
07	311 03.3	313 40.0	43.6	299 15.8	10.1	292 51.3	32.8	118 13.6	32.2
08	326 05.7	328 39.7	42.5	314 16.5	10.9	307 53.2	33.0	133 16.3	32.1
M 09	341 08.2	343 39.4	. . 41.3	329 17.1	. . 11.7	322 55.1	. . 33.2	148 18.9	. . 32.0
O 10	356 10.7	358 39.0	40.2	344 17.8	12.4	337 57.0	33.5	163 21.5	32.0
N 11	11 13.1	13 38.7	39.0	359 18.5	13.2	352 58.9	33.7	178 24.2	31.9
D 12	26 15.6	28 38.4	S 2 37.9	14 19.2	N 4 14.0	8 00.8	N 6 33.9	193 26.8	S 2 31.8
A 13	41 18.1	43 38.0	36.7	29 19.9	14.7	23 02.7	34.1	208 29.4	31.8
Y 14	56 20.5	58 37.7	35.6	44 20.6	15.5	38 04.6	34.4	223 32.1	31.7
15	71 23.0	73 37.4	. . 34.4	59 21.3	. . 16.3	53 06.6	. . 34.6	238 34.7	. . 31.6
16	86 25.5	88 37.0	33.3	74 22.0	17.0	68 08.5	34.8	253 37.3	31.5
17	101 27.9	103 36.7	32.1	89 22.7	17.8	83 10.4	35.0	268 40.0	31.5
18	116 30.4	118 36.4	S 2 31.0	104 23.4	N 4 18.6	98 12.3	N 6 35.3	283 42.6	S 2 31.4
19	131 32.9	133 36.0	29.8	119 24.1	19.3	113 14.2	35.5	298 45.2	31.3
20	146 35.3	148 35.7	28.7	134 24.8	20.1	128 16.1	35.7	313 47.9	31.3
21	161 37.8	163 35.4	. . 27.5	149 25.5	. . 20.9	143 18.0	. . 36.0	328 50.5	. . 31.2
22	176 40.2	178 35.0	26.4	164 26.2	21.6	158 19.9	36.2	343 53.1	31.1
23	191 42.7	193 34.7	25.2	179 26.9	22.4	173 21.8	36.4	358 55.8	31.1
	h m								
Mer. Pass.	10 19.2	*v* −0.3	*d* 1.1	*v* 0.7	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.7
Achernar	335 28.4	S57 10.7
Acrux	173 10.5	S63 10.0
Adhara	255 13.8	S28 59.6
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.4	N55 53.8
Alkaid	152 59.6	N49 15.3
Al Na'ir	27 45.9	S46 54.1
Alnilam	275 48.1	S 1 11.8
Alphard	217 57.5	S 8 42.7
Alphecca	126 12.0	N26 40.4
Alpheratz	357 45.5	N29 09.1
Altair	62 09.8	N 8 53.8
Ankaa	353 17.6	S42 14.6
Antares	112 27.9	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 30.8	S69 02.7
Avior	234 18.6	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.1	N 7 24.4
Canopus	263 57.1	S52 42.5
Capella	280 37.1	N46 00.6
Deneb	49 32.7	N45 19.0
Denebola	182 34.9	N14 30.4
Diphda	348 57.7	S17 55.5
Dubhe	193 53.0	N61 41.4
Elnath	278 14.8	N28 37.0
Eltanin	90 46.6	N51 29.0
Enif	33 48.8	N 9 55.6
Fomalhaut	15 25.9	S29 33.6
Gacrux	172 02.2	S57 10.8
Gienah	175 53.6	S17 36.5
Hadar	148 49.6	S60 25.8
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.7	S34 22.6
Kochab	137 18.6	N74 06.4
Markab	13 40.1	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.1	S36 25.7
Miaplacidus	221 39.8	S69 46.2
Mirfak	308 43.1	N49 54.1
Nunki	76 00.1	S26 16.9
Peacock	53 21.7	S56 41.6
Pollux	243 29.6	N27 59.9
Procyon	245 01.4	N 5 11.6
Rasalhague	96 07.7	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.8	S 8 11.5
Rigil Kent.	139 53.3	S60 52.9
Sabik	102 14.1	S15 44.4
Schedar	349 43.0	N56 35.9
Shaula	96 23.8	S37 06.6
Sirius	258 35.2	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.5	S43 29.1
Vega	80 39.9	N38 47.4
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	4 03.5	10 05
Mars	349 07.4	11 04
Jupiter	342 05.4	11 31
Saturn	167 05.0	23 08

UT	SUN			MOON					
	GHA		Dec	GHA	v		Dec	d	HP
d h	°	′	° ′	°	′	′	° ′	′	′
16 00	180	00.0	N 9 55.3	29	51.0	8.8	S 2 54.2	14.9	61.0
01	195	00.1	56.2	44	18.8	8.8	3 09.1	15.0	61.0
02	210	00.3	57.1	58	46.6	8.8	3 24.1	14.9	61.0
03	225	00.4	. . 58.0	73	14.4	8.8	3 39.0	14.8	61.0
04	240	00.6	58.9	87	42.2	8.7	3 53.8	14.9	61.1
05	255	00.7	9 59.8	102	09.9	8.6	4 08.7	14.9	61.1
06	270	00.9	N10 00.7	116	37.5	8.7	S 4 23.6	14.8	61.1
07	285	01.0	01.5	131	05.2	8.6	4 38.4	14.8	61.1
S 08	300	01.2	02.4	145	32.8	8.5	4 53.2	14.8	61.1
A 09	315	01.3	. . 03.3	160	00.3	8.5	5 08.0	14.7	61.1
T 10	330	01.5	04.2	174	27.8	8.5	5 22.7	14.8	61.1
U 11	345	01.6	05.1	188	55.3	8.4	5 37.5	14.7	61.1
R 12	0	01.8	N10 06.0	203	22.7	8.4	S 5 52.2	14.6	61.1
D 13	15	01.9	06.9	217	50.1	8.3	6 06.8	14.7	61.2
A 14	30	02.1	07.8	232	17.4	8.3	6 21.5	14.6	61.2
Y 15	45	02.2	. . 08.6	246	44.7	8.2	6 36.1	14.5	61.2
16	60	02.4	09.5	261	11.9	8.2	6 50.6	14.6	61.2
17	75	02.5	10.4	275	39.1	8.2	7 05.2	14.5	61.2
18	90	02.7	N10 11.3	290	06.3	8.1	S 7 19.7	14.4	61.2
19	105	02.8	12.2	304	33.4	8.0	7 34.1	14.4	61.2
20	120	03.0	13.1	319	00.4	8.0	7 48.5	14.4	61.2
21	135	03.1	. . 14.0	333	27.4	8.0	8 02.9	14.3	61.2
22	150	03.3	14.8	347	54.4	7.9	8 17.2	14.2	61.2
23	165	03.4	15.7	2	21.3	7.8	8 31.4	14.2	61.2
17 00	180	03.6	N10 16.6	16	48.1	7.8	S 8 45.6	14.2	61.2
01	195	03.7	17.5	31	14.9	7.8	8 59.8	14.1	61.2
02	210	03.9	18.4	45	41.7	7.7	9 13.9	14.0	61.2
03	225	04.0	. . 19.3	60	08.4	7.6	9 27.9	14.0	61.2
04	240	04.2	20.1	74	35.0	7.6	9 41.9	13.9	61.2
05	255	04.3	21.0	89	01.6	7.6	9 55.8	13.8	61.2
06	270	04.4	N10 21.9	103	28.2	7.5	S10 09.6	13.8	61.2
07	285	04.6	22.8	117	54.7	7.4	10 23.4	13.7	61.2
08	300	04.7	23.7	132	21.1	7.4	10 37.1	13.7	61.2
S 09	315	04.9	. . 24.5	146	47.5	7.3	10 50.8	13.6	61.2
U 10	330	05.0	25.4	161	13.8	7.3	11 04.4	13.5	61.2
N 11	345	05.2	26.3	175	40.1	7.2	11 17.9	13.4	61.2
D 12	0	05.3	N10 27.2	190	06.3	7.2	S11 31.3	13.3	61.2
A 13	15	05.5	28.1	204	32.5	7.1	11 44.6	13.3	61.2
Y 14	30	05.6	28.9	218	58.6	7.0	11 57.9	13.2	61.2
15	45	05.8	. . 29.8	233	24.6	7.0	12 11.1	13.1	61.2
16	60	05.9	30.7	247	50.6	7.0	12 24.2	13.1	61.2
17	75	06.0	31.6	262	16.6	6.9	12 37.3	12.9	61.2
18	90	06.2	N10 32.5	276	42.5	6.8	S12 50.2	12.9	61.2
19	105	06.3	33.3	291	08.3	6.8	13 03.1	12.7	61.2
20	120	06.5	34.2	305	34.1	6.7	13 15.8	12.7	61.2
21	135	06.6	. . 35.1	319	59.8	6.7	13 28.5	12.6	61.2
22	150	06.8	36.0	334	25.5	6.6	13 41.1	12.5	61.2
23	165	06.9	36.8	348	51.1	6.6	13 53.6	12.4	61.2
18 00	180	07.0	N10 37.7	3	16.7	6.5	S14 06.0	12.3	61.1
01	195	07.2	38.6	17	42.2	6.4	14 18.3	12.2	61.1
02	210	07.3	39.5	32	07.6	6.4	14 30.5	12.1	61.1
03	225	07.5	. . 40.3	46	33.0	6.4	14 42.6	12.0	61.1
04	240	07.6	41.2	60	58.4	6.3	14 54.6	11.8	61.1
05	255	07.8	42.1	75	23.7	6.2	15 06.4	11.8	61.1
06	270	07.9	N10 43.0	89	48.9	6.2	S15 18.2	11.7	61.1
07	285	08.0	43.8	104	14.1	6.1	15 29.9	11.5	61.1
08	300	08.2	44.7	118	39.2	6.1	15 41.4	11.5	61.0
M 09	315	08.3	. . 45.6	133	04.3	6.0	15 52.9	11.3	61.0
O 10	330	08.5	46.5	147	29.3	6.0	16 04.2	11.3	61.0
N 11	345	08.6	47.3	161	54.3	5.9	16 15.5	11.1	61.0
D 12	0	08.8	N10 48.2	176	19.2	5.9	S16 26.6	10.9	61.0
A 13	15	08.9	49.1	190	44.1	5.8	16 37.5	10.9	61.0
Y 14	30	09.0	50.0	205	08.9	5.8	16 48.4	10.8	61.0
15	45	09.2	. . 50.8	219	33.7	5.7	16 59.2	10.6	60.9
16	60	09.3	51.7	233	58.4	5.7	17 09.8	10.5	60.9
17	75	09.5	52.6	248	23.1	5.6	17 20.3	10.4	60.9
18	90	09.6	N10 53.4	262	47.7	5.6	S17 30.7	10.2	60.9
19	105	09.7	54.3	277	12.3	5.5	17 40.9	10.1	60.9
20	120	09.9	55.2	291	36.8	5.5	17 51.0	10.0	60.8
21	135	10.0	. . 56.1	306	01.3	5.5	18 01.0	9.9	60.8
22	150	10.2	56.9	320	25.8	5.4	18 10.9	9.7	60.8
23	165	10.3	57.8	334	50.2	5.3	S18 20.6	9.6	60.8
	SD	16.0	d 0.9	SD	16.7		16.7		16.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 16	Moonrise 17	Moonrise 18	Moonrise 19
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	01 41	03 30	18 17	20 53	▬	▬
N 70	////	02 23	03 48	18 05	20 24	23 10	▬
68	////	02 51	04 02	17 55	20 03	22 21	25 24
66	01 27	03 11	04 14	17 48	19 47	21 50	23 56
64	02 05	03 28	04 23	17 41	19 33	21 27	23 18
62	02 30	03 41	04 32	17 35	19 22	21 09	22 51
60	02 49	03 52	04 39	17 31	19 13	20 54	22 31
N 58	03 05	04 02	04 45	17 26	19 04	20 42	22 14
56	03 18	04 10	04 51	17 23	18 57	20 31	22 00
54	03 29	04 17	04 56	17 19	18 51	20 21	21 47
52	03 39	04 24	05 00	17 16	18 45	20 13	21 36
50	03 47	04 30	05 04	17 13	18 40	20 05	21 27
45	04 05	04 42	05 13	17 07	18 28	19 49	21 07
N 40	04 18	04 52	05 20	17 02	18 19	19 36	20 50
35	04 29	05 00	05 26	16 58	18 11	19 25	20 37
30	04 38	05 07	05 32	16 54	18 04	19 15	20 25
20	04 52	05 18	05 41	16 48	17 53	18 59	20 04
N 10	05 03	05 27	05 49	16 42	17 42	18 44	19 47
0	05 11	05 35	05 56	16 37	17 33	18 31	19 31
S 10	05 18	05 42	06 04	16 32	17 23	18 17	19 14
20	05 23	05 49	06 11	16 27	17 13	18 03	18 57
30	05 28	05 56	06 20	16 21	17 02	17 47	18 37
35	05 30	05 59	06 25	16 17	16 56	17 38	18 26
40	05 32	06 03	06 31	16 13	16 48	17 27	18 12
45	05 33	06 07	06 37	16 09	16 40	17 15	17 57
S 50	05 34	06 12	06 45	16 03	16 30	17 00	17 38
52	05 35	06 14	06 48	16 01	16 25	16 53	17 29
54	05 35	06 16	06 52	15 58	16 20	16 46	17 19
56	05 35	06 18	06 56	15 55	16 14	16 37	17 08
58	05 35	06 21	07 01	15 52	16 08	16 28	16 55
S 60	05 35	06 24	07 07	15 49	16 01	16 17	16 40

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 16	Moonset 17	Moonset 18	Moonset 19
°	h m	h m	h m	h m	h m	h m	h m
N 72	20 34	22 28	////	03 19	02 53	02 16	▬
N 70	20 15	21 42	////	03 24	03 08	02 46	02 04
68	20 00	21 13	////	03 29	03 20	03 09	02 53
66	19 48	20 51	22 40	03 32	03 30	03 27	03 25
64	19 38	20 34	22 00	03 35	03 38	03 42	03 49
62	19 29	20 21	21 33	03 38	03 45	03 54	04 08
60	19 22	20 09	21 13	03 41	03 51	04 05	04 24
N 58	19 16	19 59	20 57	03 43	03 57	04 14	04 37
56	19 10	19 51	20 43	03 45	04 02	04 22	04 48
54	19 05	19 43	20 32	03 46	04 06	04 29	04 58
52	19 00	19 37	20 22	03 48	04 10	04 36	05 08
50	18 56	19 31	20 13	03 49	04 14	04 42	05 16
45	18 47	19 18	19 56	03 52	04 22	04 55	05 33
N 40	18 40	19 08	19 42	03 55	04 28	05 05	05 47
35	18 34	19 00	19 31	03 57	04 34	05 14	05 59
30	18 28	18 53	19 22	03 59	04 39	05 22	06 10
20	18 19	18 41	19 08	04 03	04 48	05 36	06 28
N 10	18 11	18 32	18 57	04 06	04 56	05 49	06 44
0	18 03	18 24	18 48	04 09	05 03	06 00	06 59
S 10	17 56	18 17	18 42	04 12	05 11	06 12	07 14
20	17 48	18 10	18 36	04 15	05 19	06 24	07 30
30	17 39	18 03	18 31	04 18	05 28	06 38	07 48
35	17 34	17 59	18 29	04 20	05 33	06 46	07 59
40	17 28	17 56	18 27	04 23	05 39	06 56	08 12
45	17 22	17 51	18 26	04 25	05 46	07 07	08 26
S 50	17 14	17 47	18 24	04 28	05 54	07 20	08 44
52	17 10	17 45	18 24	04 30	05 58	07 27	08 53
54	17 06	17 42	18 23	04 31	06 02	07 33	09 02
56	17 02	17 40	18 23	04 33	06 07	07 41	09 13
58	16 57	17 37	18 23	04 35	06 12	07 50	09 26
S 60	16 52	17 34	18 23	04 37	06 18	08 00	09 40

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
16	00 00	00 07	12 00	22 50	10 23	13	96
17	00 14	00 21	12 00	23 46	11 18	14	99
18	00 28	00 35	11 59	24 45	12 15	15	100

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
19 00	206 45.2	208 34.4	S 2 24.1	194 27.6	N 4 23.2	188 23.7	N 6 36.6	13 58.4	S 2 31.0
01	221 47.6	223 34.0	22.9	209 28.2	23.9	203 25.6	36.9	29 01.0	30.9
02	236 50.1	238 33.7	21.8	224 28.9	24.7	218 27.5	37.1	44 03.7	30.9
03	251 52.6	253 33.4	. . 20.6	239 29.6	. . 25.5	233 29.4	. . 37.3	59 06.3	. . 30.8
04	266 55.0	268 33.1	19.5	254 30.3	26.2	248 31.3	37.5	74 09.0	30.7
05	281 57.5	283 32.7	18.3	269 31.0	27.0	263 33.2	37.8	89 11.6	30.7
06	297 00.0	298 32.4	S 2 17.2	284 31.7	N 4 27.7	278 35.1	N 6 38.0	104 14.2	S 2 30.6
07	312 02.4	313 32.1	16.0	299 32.4	28.5	293 37.0	38.2	119 16.9	30.5
T 08	327 04.9	328 31.7	14.9	314 33.1	29.3	308 38.9	38.4	134 19.5	30.5
U 09	342 07.4	343 31.4	. . 13.7	329 33.8	. . 30.0	323 40.8	. . 38.7	149 22.1	. . 30.4
E 10	357 09.8	358 31.1	12.6	344 34.5	30.8	338 42.7	38.9	164 24.7	30.3
S 11	12 12.3	13 30.7	11.4	359 35.2	31.6	353 44.6	39.1	179 27.4	30.2
D 12	27 14.7	28 30.4	S 2 10.3	14 35.9	N 4 32.3	8 46.6	N 6 39.3	194 30.0	S 2 30.2
A 13	42 17.2	43 30.1	09.1	29 36.6	33.1	23 48.5	39.6	209 32.6	30.1
Y 14	57 19.7	58 29.7	08.0	44 37.3	33.9	38 50.4	39.8	224 35.3	30.0
15	72 22.1	73 29.4	. . 06.8	59 38.0	. . 34.6	53 52.3	. . 40.0	239 37.9	. . 30.0
16	87 24.6	88 29.1	05.7	74 38.7	35.4	68 54.2	40.2	254 40.5	29.9
17	102 27.1	103 28.7	04.5	89 39.3	36.1	83 56.1	40.5	269 43.2	29.8
18	117 29.5	118 28.4	S 2 03.4	104 40.0	N 4 36.9	98 58.0	N 6 40.7	284 45.8	S 2 29.8
19	132 32.0	133 28.1	02.2	119 40.7	37.7	113 59.9	40.9	299 48.4	29.7
20	147 34.5	148 27.7	2 01.1	134 41.4	38.4	129 01.8	41.1	314 51.1	29.6
21	162 36.9	163 27.4	1 59.9	149 42.1	. . 39.2	144 03.7	. . 41.4	329 53.7	. . 29.6
22	177 39.4	178 27.1	58.7	164 42.8	40.0	159 05.6	41.6	344 56.3	29.5
23	192 41.9	193 26.8	57.6	179 43.5	40.7	174 07.5	41.8	359 59.0	29.4
20 00	207 44.3	208 26.4	S 1 56.4	194 44.2	N 4 41.5	189 09.4	N 6 42.1	15 01.6	S 2 29.4
01	222 46.8	223 26.1	55.3	209 44.9	42.2	204 11.3	42.3	30 04.2	29.3
02	237 49.2	238 25.8	54.1	224 45.6	43.0	219 13.2	42.5	45 06.9	29.2
03	252 51.7	253 25.4	. . 53.0	239 46.3	. . 43.8	234 15.1	. . 42.7	60 09.5	. . 29.2
04	267 54.2	268 25.1	51.8	254 47.0	44.5	249 17.0	43.0	75 12.1	29.1
05	282 56.6	283 24.8	50.7	269 47.7	45.3	264 18.9	43.2	90 14.8	29.0
06	297 59.1	298 24.4	S 1 49.5	284 48.4	N 4 46.1	279 20.8	N 6 43.4	105 17.4	S 2 29.0
W 07	313 01.6	313 24.1	48.4	299 49.1	46.8	294 22.7	43.6	120 20.0	28.9
E 08	328 04.0	328 23.8	47.2	314 49.7	47.6	309 24.6	43.9	135 22.7	28.8
D 09	343 06.5	343 23.5	. . 46.0	329 50.4	. . 48.3	324 26.6	. . 44.1	150 25.3	. . 28.8
N 10	358 09.0	358 23.1	44.9	344 51.1	49.1	339 28.5	44.3	165 27.9	28.7
E 11	13 11.4	13 22.8	43.7	359 51.8	49.9	354 30.4	44.5	180 30.6	28.6
S 12	28 13.9	28 22.5	S 1 42.6	14 52.5	N 4 50.6	9 32.3	N 6 44.8	195 33.2	S 2 28.6
D 13	43 16.3	43 22.1	41.4	29 53.2	51.4	24 34.2	45.0	210 35.8	28.5
A 14	58 18.8	58 21.8	40.3	44 53.9	52.1	39 36.1	45.2	225 38.5	28.4
Y 15	73 21.3	73 21.5	. . 39.1	59 54.6	. . 52.9	54 38.0	. . 45.4	240 41.1	. . 28.4
16	88 23.7	88 21.1	38.0	74 55.3	53.7	69 39.9	45.7	255 43.7	28.3
17	103 26.2	103 20.8	36.8	89 56.0	54.4	84 41.8	45.9	270 46.3	28.2
18	118 28.7	118 20.5	S 1 35.6	104 56.7	N 4 55.2	99 43.7	N 6 46.1	285 49.0	S 2 28.2
19	133 31.1	133 20.2	34.5	119 57.4	56.0	114 45.6	46.3	300 51.6	28.1
20	148 33.6	148 19.8	33.3	134 58.1	56.7	129 47.5	46.6	315 54.2	28.0
21	163 36.1	163 19.5	. . 32.2	149 58.8	. . 57.5	144 49.4	. . 46.8	330 56.9	. . 28.0
22	178 38.5	178 19.2	31.0	164 59.5	58.2	159 51.3	47.0	345 59.5	27.9
23	193 41.0	193 18.8	29.9	180 00.1	59.0	174 53.2	47.2	1 02.1	27.8
21 00	208 43.5	208 18.5	S 1 28.7	195 00.8	N 4 59.8	189 55.1	N 6 47.5	16 04.8	S 2 27.8
01	223 45.9	223 18.2	27.6	210 01.5	5 00.5	204 57.0	47.7	31 07.4	27.7
02	238 48.4	238 17.8	26.4	225 02.2	01.3	219 58.9	47.9	46 10.0	27.6
03	253 50.8	253 17.5	. . 25.2	240 02.9	. . 02.0	235 00.9	. . 48.1	61 12.7	. . 27.6
04	268 53.3	268 17.2	24.1	255 03.6	02.8	250 02.8	48.4	76 15.3	27.5
05	283 55.8	283 16.9	22.9	270 04.3	03.6	265 04.7	48.6	91 17.9	27.4
06	298 58.2	298 16.5	S 1 21.8	285 05.0	N 5 04.3	280 06.6	N 6 48.8	106 20.5	S 2 27.4
07	314 00.7	313 16.2	20.6	300 05.7	05.1	295 08.5	49.0	121 23.2	27.3
T 08	329 03.2	328 15.9	19.4	315 06.4	05.8	310 10.4	49.3	136 25.8	27.2
H 09	344 05.6	343 15.5	. . 18.3	330 07.1	. . 06.6	325 12.3	. . 49.5	151 28.4	. . 27.2
U 10	359 08.1	358 15.2	17.1	345 07.8	07.3	340 14.2	49.7	166 31.1	27.1
R 11	14 10.6	13 14.9	16.0	0 08.5	08.1	355 16.1	49.9	181 33.7	27.0
S 12	29 13.0	28 14.6	S 1 14.8	15 09.2	N 5 08.9	10 18.0	N 6 50.2	196 36.3	S 2 27.0
D 13	44 15.5	43 14.2	13.7	30 09.9	09.6	25 19.9	50.4	211 39.0	26.9
A 14	59 18.0	58 13.9	12.5	45 10.5	10.4	40 21.8	50.6	226 41.6	26.8
Y 15	74 20.4	73 13.6	. . 11.3	60 11.2	. . 11.1	55 23.7	. . 50.8	241 44.2	. . 26.8
16	89 22.9	88 13.2	10.2	75 11.9	11.9	70 25.6	51.0	256 46.8	26.7
17	104 25.3	103 12.9	09.0	90 12.6	12.7	85 27.5	51.3	271 49.5	26.6
18	119 27.8	118 12.6	S 1 07.9	105 13.3	N 5 13.4	100 29.4	N 6 51.5	286 52.1	S 2 26.6
19	134 30.3	133 12.3	06.7	120 14.0	14.2	115 31.3	51.7	301 54.7	26.5
20	149 32.7	148 11.9	05.5	135 14.7	14.9	130 33.2	51.9	316 57.4	26.4
21	164 35.2	163 11.6	. . 04.4	150 15.4	. . 15.7	145 35.2	. . 52.2	332 00.0	. . 26.4
22	179 37.7	178 11.3	03.2	165 16.1	16.4	160 37.1	52.4	347 02.6	26.3
23	194 40.1	193 10.9	02.1	180 16.8	17.2	175 39.0	52.6	2 05.3	26.2
	h m								
Mer. Pass.	10 07.4	*v* −0.3	*d* 1.2	*v* 0.7	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.7
Achernar	335 28.4	S57 10.7
Acrux	173 10.5	S63 10.0
Adhara	255 13.9	S28 59.6
Aldebaran	290 51.4	N16 31.8
Alioth	166 21.4	N55 53.8
Alkaid	152 59.6	N49 15.3
Al Na'ir	27 45.8	S46 54.1
Alnilam	275 48.1	S 1 11.8
Alphard	217 57.5	S 8 42.7
Alphecca	126 12.0	N26 40.4
Alpheratz	357 45.5	N29 09.1
Altair	62 09.7	N 8 53.8
Ankaa	353 17.5	S42 14.6
Antares	112 27.9	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 30.8	S69 02.7
Avior	234 18.7	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.1	S52 42.4
Capella	280 37.1	N46 00.6
Deneb	49 32.6	N45 19.0
Denebola	182 35.0	N14 30.4
Diphda	348 57.7	S17 55.5
Dubhe	193 53.0	N61 41.4
Elnath	278 14.8	N28 37.0
Eltanin	90 46.6	N51 29.0
Enif	33 48.8	N 9 55.6
Fomalhaut	15 25.9	S29 33.6
Gacrux	172 02.2	S57 10.9
Gienah	175 53.6	S17 36.5
Hadar	148 49.6	S60 25.8
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.7	S34 22.6
Kochab	137 18.6	N74 06.4
Markab	13 40.1	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.0	S36 25.7
Miaplacidus	221 39.9	S69 46.2
Mirfak	308 43.1	N49 54.1
Nunki	76 00.1	S26 16.8
Peacock	53 21.7	S56 41.6
Pollux	243 29.6	N27 59.9
Procyon	245 01.4	N 5 11.6
Rasalhague	96 07.7	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.8	S 8 11.5
Rigil Kent.	139 53.3	S60 52.9
Sabik	102 14.1	S15 44.4
Schedar	349 42.9	N56 35.9
Shaula	96 23.8	S37 06.6
Sirius	258 35.2	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.5	S43 29.1
Vega	80 39.9	N38 47.4
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	0 42.1	10 06
Mars	346 59.9	11 01
Jupiter	341 25.1	11 22
Saturn	167 17.3	22 56

UT	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise			
									Naut.	Civil		19	20	21	22
	GHA	Dec	GHA	v	Dec	d	HP								
d h	° ′	° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
19 00	180 10.4	N10 58.7	349 14.5	5.4	S18 30.2	9.4	60.7	N 72	////	01 02	03 12				
01	195 10.6	10 59.5	3 38.9	5.2	18 39.6	9.4	60.7	N 70	////	02 00	03 33				
02	210 10.7	11 00.4	18 03.1	5.3	18 49.0	9.1	60.7	68	////	02 33	03 49	25 24	01 24		
03	225 10.8	. . 01.3	32 27.4	5.2	18 58.1	9.1	60.7	66	00 54	02 57	04 02	23 56	25 52	01 52	02 49
04	240 11.0	02.1	46 51.6	5.1	19 07.2	8.9	60.7	64	01 45	03 15	04 13	23 18	24 52	00 52	01 51
05	255 11.1	03.0	61 15.7	5.2	19 16.1	8.8	60.6	62	02 15	03 30	04 22	22 51	24 18	00 18	01 18
06	270 11.3	N11 03.9	75 39.9	5.1	S19 24.9	8.6	60.6	60	02 37	03 42	04 30	22 31	23 53	24 53	00 53
07	285 11.4	04.7	90 04.0	5.0	19 33.5	8.5	60.6	N 58	02 54	03 53	04 37	22 14	23 33	24 33	00 33
T 08	300 11.5	05.6	104 28.0	5.0	19 42.0	8.3	60.6	56	03 09	04 02	04 43	22 00	23 17	24 17	00 17
U 09	315 11.7	. . 06.5	118 52.0	5.0	19 50.3	8.2	60.5	54	03 21	04 10	04 49	21 47	23 03	24 03	00 03
E 10	330 11.8	07.3	133 16.0	5.0	19 58.5	8.0	60.5	52	03 31	04 17	04 54	21 36	22 50	23 51	24 37
S 11	345 11.9	08.2	147 40.0	4.9	20 06.5	7.9	60.5	50	03 40	04 23	04 58	21 27	22 40	23 40	24 27
D 12	0 12.1	N11 09.1	162 03.9	4.9	S20 14.4	7.8	60.4	45	03 59	04 37	05 08	21 07	22 17	23 17	24 07
A 13	15 12.2	09.9	176 27.8	4.9	20 22.2	7.6	60.4	N 40	04 13	04 47	05 16	20 50	21 59	22 59	23 50
Y 14	30 12.4	10.8	190 51.7	4.9	20 29.8	7.4	60.4	35	04 25	04 56	05 22	20 37	21 44	22 44	23 36
15	45 12.5	. . 11.7	205 15.6	4.8	20 37.2	7.3	60.4	30	04 34	05 04	05 28	20 25	21 31	22 31	23 23
16	60 12.6	12.5	219 39.4	4.8	20 44.5	7.2	60.3	20	04 49	05 16	05 39	20 04	21 08	22 08	23 02
17	75 12.8	13.4	234 03.2	4.8	20 51.7	7.0	60.3	N 10	05 01	05 26	05 47	19 47	20 49	21 49	22 44
18	90 12.9	N11 14.2	248 27.0	4.8	S20 58.7	6.8	60.3	0	05 10	05 35	05 56	19 31	20 31	21 30	22 27
19	105 13.0	15.1	262 50.8	4.7	21 05.5	6.7	60.2	S 10	05 18	05 42	06 04	19 14	20 13	21 12	22 10
20	120 13.2	16.0	277 14.5	4.8	21 12.2	6.5	60.2	20	05 24	05 50	06 12	18 57	19 54	20 53	21 51
21	135 13.3	. . 16.8	291 38.3	4.7	21 18.7	6.4	60.2	30	05 30	05 58	06 22	18 37	19 32	20 30	21 30
22	150 13.4	17.7	306 02.0	4.7	21 25.1	6.2	60.2	35	05 32	06 02	06 27	18 26	19 19	20 17	21 18
23	165 13.6	18.6	320 25.7	4.7	21 31.3	6.1	60.1	40	05 34	06 06	06 34	18 12	19 04	20 02	21 04
20 00	180 13.7	N11 19.4	334 49.4	4.7	S21 37.4	5.9	60.1	45	05 36	06 11	06 41	17 57	18 47	19 44	20 47
01	195 13.8	20.3	349 13.1	4.7	21 43.3	5.8	60.1	S 50	05 38	06 16	06 49	17 38	18 25	19 21	20 26
02	210 14.0	21.1	3 36.8	4.6	21 49.1	5.6	60.0	52	05 39	06 19	06 53	17 29	18 14	19 11	20 15
03	225 14.1	. . 22.0	18 00.4	4.7	21 54.7	5.4	60.0	54	05 40	06 21	06 58	17 19	18 03	18 58	20 04
04	240 14.2	22.9	32 24.1	4.7	22 00.1	5.3	60.0	56	05 41	06 24	07 02	17 08	17 50	18 44	19 51
05	255 14.4	23.7	46 47.8	4.6	22 05.4	5.1	59.9	58	05 41	06 27	07 08	16 55	17 34	18 28	19 36
06	270 14.5	N11 24.6	61 11.4	4.7	S22 10.5	4.9	59.9	S 60	05 42	06 30	07 14	16 40	17 16	18 09	19 18
W 07	285 14.6	25.4	75 35.1	4.7	22 15.4	4.8	59.9								
E 08	300 14.8	26.3	89 58.8	4.6	22 20.2	4.7	59.8								
D 09	315 14.9	. . 27.2	104 22.4	4.7	22 24.9	4.5	59.8								
N 10	330 15.0	28.0	118 46.1	4.7	22 29.4	4.3	59.8								
E 11	345 15.2	28.9	133 09.8	4.7	22 33.7	4.1	59.7								
S 12	0 15.3	N11 29.7	147 33.5	4.7	S22 37.8	4.0	59.7								
D 13	15 15.4	30.6	161 57.2	4.7	22 41.8	3.9	59.6								
A 14	30 15.6	31.4	176 20.9	4.7	22 45.7	3.6	59.6								
Y 15	45 15.7	. . 32.3	190 44.6	4.7	22 49.3	3.6	59.6								
16	60 15.8	33.2	205 08.3	4.8	22 52.9	3.3	59.5								
17	75 16.0	34.0	219 32.1	4.8	22 56.2	3.2	59.5								
18	90 16.1	N11 34.9	233 55.9	4.8	S22 59.4	3.0	59.5								
19	105 16.2	35.7	248 19.7	4.8	23 02.4	2.9	59.4								
20	120 16.4	36.6	262 43.5	4.8	23 05.3	2.7	59.4								
21	135 16.5	. . 37.4	277 07.3	4.9	23 08.0	2.6	59.3								
22	150 16.6	38.3	291 31.2	4.9	23 10.6	2.4	59.3								
23	165 16.8	39.1	305 55.1	4.9	23 13.0	2.2	59.3								
21 00	180 16.9	N11 40.0	320 19.0	5.0	S23 15.2	2.1	59.2								
01	195 17.0	40.9	334 43.0	5.0	23 17.3	1.9	59.2								
02	210 17.1	41.7	349 07.0	5.0	23 19.2	1.7	59.2								
03	225 17.3	. . 42.6	3 31.0	5.1	23 20.9	1.6	59.1								
04	240 17.4	43.4	17 55.1	5.1	23 22.5	1.4	59.1								
05	255 17.5	44.3	32 19.2	5.1	23 23.9	1.3	59.0								
06	270 17.7	N11 45.1	46 43.3	5.2	S23 25.2	1.1	59.0								
07	285 17.8	46.0	61 07.5	5.3	23 26.3	1.0	59.0								
T 08	300 17.9	46.8	75 31.8	5.2	23 27.3	0.8	58.9								
H 09	315 18.0	. . 47.7	89 56.0	5.4	23 28.1	0.6	58.9								
U 10	330 18.2	48.5	104 20.4	5.3	23 28.7	0.5	58.8								
R 11	345 18.3	49.4	118 44.7	5.4	23 29.2	0.4	58.8								
S 12	0 18.4	N11 50.2	133 09.1	5.5	S23 29.6	0.2	58.8								
D 13	15 18.6	51.1	147 33.6	5.5	23 29.8	0.0	58.7								
A 14	30 18.7	51.9	161 58.1	5.6	23 29.8	0.1	58.7								
Y 15	45 18.8	. . 52.8	176 22.7	5.7	23 29.7	0.3	58.6								
16	60 18.9	53.6	190 47.4	5.7	23 29.4	0.4	58.6								
17	75 19.1	54.5	205 12.1	5.7	23 29.0	0.6	58.6								
18	90 19.2	N11 55.3	219 36.8	5.8	S23 28.4	0.7	58.5								
19	105 19.3	56.2	234 01.6	5.9	23 27.7	0.9	58.5								
20	120 19.4	57.0	248 26.5	6.0	23 26.8	1.0	58.4								
21	135 19.6	. . 57.8	262 51.5	6.0	23 25.8	1.2	58.4								
22	150 19.7	58.7	277 16.5	6.0	23 24.6	1.3	58.4								
23	165 19.8	59.5	291 41.5	6.2	S23 23.3	1.5	58.3								
	SD 15.9	d 0.9	SD 16.5		16.3		16.0								

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	19	20	21	22
°	h m	h m	h m	h m	h m	h m	h m
N 72	20 51	23 13	////	02 04			
N 70	20 29	22 04	////	02 53	01 57		
68	20 12	21 29	////	03 25	03 26	03 36	04 43
66	19 58	21 05	23 20	03 49	04 04	04 37	05 40
64	19 47	20 46	22 19	04 08	04 31	05 11	06 14
62	19 38	20 30	21 47	04 24	04 52	05 36	06 38
60	19 30	20 18	21 24	04 37	05 09	05 56	06 58
N 58	19 22	20 07	21 06	04 48	05 24	06 12	07 14
56	19 16	19 58	20 52	04 58	05 37	06 26	07 28
54	19 11	19 50	20 39	05 08	05 48	06 39	07 40
52	19 06	19 42	20 29	05 16	05 58	06 50	07 50
50	19 01	19 36	20 19	05 33	06 19	07 12	08 13
45	18 51	19 22	20 00	05 47	06 36	07 30	08 31
N 40	18 43	19 12	19 46	05 59	06 50	07 46	08 46
35	18 36	19 03	19 34	06 10	07 02	07 59	08 59
30	18 30	18 55	19 24	06 28	07 24	08 22	09 21
20	18 20	18 42	19 09	06 44	07 42	08 41	09 40
N 10	18 11	18 32	18 57	06 59	07 59	09 00	09 58
0	18 02	18 23	18 48	07 14	08 17	09 18	10 16
S 10	17 54	18 15	18 40	07 30	08 35	09 37	10 35
20	17 45	18 08	18 34	07 48	08 57	10 00	10 57
30	17 36	18 00	18 28	07 59	09 09	10 13	11 09
35	17 30	17 56	18 25	08 12	09 24	10 28	11 24
40	17 24	17 51	18 23	08 26	09 41	10 47	11 41
45	17 17	17 47	18 21	08 44	10 02	11 09	12 03
S 50	17 08	17 41	18 19	08 53	10 12	11 20	12 13
52	17 04	17 39	18 18	09 02	10 24	11 32	12 25
54	17 00	17 36	18 17	09 13	10 37	11 46	12 38
56	16 55	17 33	18 16	09 26	10 52	12 02	12 53
58	16 49	17 30	18 16	09 40	11 10	12 22	13 11
S 60	16 43	17 26	18 15				

Day	SUN			MOON				
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
19	00 41	00 48	11 59	00 45	13 15	16	97
20	00 55	01 01	11 59	01 45	14 15	17	92
21	01 07	01 13	11 59	02 45	15 15	18	85

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
22 00	209 42.6	208 10.6	S 1 00.9	195 17.5	N 5 18.0	190 40.9	N 6 52.8	17 07.9	S 2 26.2
01	224 45.1	223 10.3	0 59.7	210 18.2	18.7	205 42.8	53.1	32 10.5	26.1
02	239 47.5	238 10.0	58.6	225 18.9	19.5	220 44.7	53.3	47 13.1	26.0
03	254 50.0	253 09.6	. . 57.4	240 19.6	. . 20.2	235 46.6	. . 53.5	62 15.8	. . 26.0
04	269 52.5	268 09.3	56.3	255 20.2	21.0	250 48.5	53.7	77 18.4	25.9
05	284 54.9	283 09.0	55.1	270 20.9	21.7	265 50.4	54.0	92 21.0	25.8
06	299 57.4	298 08.6	S 0 53.9	285 21.6	N 5 22.5	280 52.3	N 6 54.2	107 23.7	S 2 25.8
07	314 59.8	313 08.3	52.8	300 22.3	23.3	295 54.2	54.4	122 26.3	25.7
08	330 02.3	328 08.0	51.6	315 23.0	24.0	310 56.1	54.6	137 28.9	25.6
F 09	345 04.8	343 07.7	. . 50.5	330 23.7	. . 24.8	325 58.0	. . 54.9	152 31.5	. . 25.6
R 10	0 07.2	358 07.3	49.3	345 24.4	25.5	340 59.9	55.1	167 34.2	25.5
I 11	15 09.7	13 07.0	48.1	0 25.1	26.3	356 01.8	55.3	182 36.8	25.4
D 12	30 12.2	28 06.7	S 0 47.0	15 25.8	N 5 27.0	11 03.7	N 6 55.5	197 39.4	S 2 25.4
A 13	45 14.6	43 06.3	45.8	30 26.5	27.8	26 05.6	55.8	212 42.1	25.3
Y 14	60 17.1	58 06.0	44.7	45 27.2	28.5	41 07.6	56.0	227 44.7	25.2
15	75 19.6	73 05.7	. . 43.5	60 27.9	. . 29.3	56 09.5	. . 56.2	242 47.3	. . 25.2
16	90 22.0	88 05.4	42.3	75 28.6	30.1	71 11.4	56.4	257 49.9	25.1
17	105 24.5	103 05.0	41.2	90 29.3	30.8	86 13.3	56.7	272 52.6	25.0
18	120 26.9	118 04.7	S 0 40.0	105 30.0	N 5 31.6	101 15.2	N 6 56.9	287 55.2	S 2 25.0
19	135 29.4	133 04.4	38.8	120 30.6	32.3	116 17.1	57.1	302 57.8	24.9
20	150 31.9	148 04.1	37.7	135 31.3	33.1	131 19.0	57.3	318 00.5	24.9
21	165 34.3	163 03.7	. . 36.5	150 32.0	. . 33.8	146 20.9	. . 57.5	333 03.1	. . 24.8
22	180 36.8	178 03.4	35.4	165 32.7	34.6	161 22.8	57.8	348 05.7	24.7
23	195 39.3	193 03.1	34.2	180 33.4	35.3	176 24.7	58.0	3 08.3	24.7
23 00	210 41.7	208 02.7	S 0 33.0	195 34.1	N 5 36.1	191 26.6	N 6 58.2	18 11.0	S 2 24.6
01	225 44.2	223 02.4	31.9	210 34.8	36.9	206 28.5	58.4	33 13.6	24.5
02	240 46.7	238 02.1	30.7	225 35.5	37.6	221 30.4	58.7	48 16.2	24.5
03	255 49.1	253 01.8	. . 29.6	240 36.2	. . 38.4	236 32.3	. . 58.9	63 18.9	. . 24.4
04	270 51.6	268 01.4	28.4	255 36.9	39.1	251 34.2	59.1	78 21.5	24.3
05	285 54.1	283 01.1	27.2	270 37.6	39.9	266 36.1	59.3	93 24.1	24.3
06	300 56.5	298 00.8	S 0 26.1	285 38.3	N 5 40.6	281 38.1	N 6 59.6	108 26.7	S 2 24.2
07	315 59.0	313 00.4	24.9	300 39.0	41.4	296 40.0	6 59.8	123 29.4	24.1
S 08	331 01.4	328 00.1	23.7	315 39.6	42.1	311 41.9	7 00.0	138 32.0	24.1
A 09	346 03.9	342 59.8	. . 22.6	330 40.3	. . 42.9	326 43.8	. . 00.2	153 34.6	. . 24.0
T 10	1 06.4	357 59.5	21.4	345 41.0	43.6	341 45.7	00.5	168 37.2	23.9
U 11	16 08.8	12 59.1	20.2	0 41.7	44.4	356 47.6	00.7	183 39.9	23.9
R 12	31 11.3	27 58.8	S 0 19.1	15 42.4	N 5 45.1	11 49.5	N 7 00.9	198 42.5	S 2 23.8
D 13	46 13.8	42 58.5	17.9	30 43.1	45.9	26 51.4	01.1	213 45.1	23.7
A 14	61 16.2	57 58.2	16.8	45 43.8	46.6	41 53.3	01.3	228 47.8	23.7
Y 15	76 18.7	72 57.8	. . 15.6	60 44.5	. . 47.4	56 55.2	. . 01.6	243 50.4	. . 23.6
16	91 21.2	87 57.5	14.4	75 45.2	48.2	71 57.1	01.8	258 53.0	23.6
17	106 23.6	102 57.2	13.3	90 45.9	48.9	86 59.0	02.0	273 55.6	23.5
18	121 26.1	117 56.8	S 0 12.1	105 46.6	N 5 49.7	102 00.9	N 7 02.2	288 58.3	S 2 23.4
19	136 28.6	132 56.5	10.9	120 47.3	50.4	117 02.8	02.5	304 00.9	23.4
20	151 31.0	147 56.2	09.8	135 48.0	51.2	132 04.7	02.7	319 03.5	23.3
21	166 33.5	162 55.9	. . 08.6	150 48.7	. . 51.9	147 06.7	. . 02.9	334 06.1	. . 23.2
22	181 35.9	177 55.5	07.4	165 49.3	52.7	162 08.6	03.1	349 08.8	23.2
23	196 38.4	192 55.2	06.3	180 50.0	53.4	177 10.5	03.4	4 11.4	23.1
24 00	211 40.9	207 54.9	S 0 05.1	195 50.7	N 5 54.2	192 12.4	N 7 03.6	19 14.0	S 2 23.0
01	226 43.3	222 54.6	04.0	210 51.4	54.9	207 14.3	03.8	34 16.6	23.0
02	241 45.8	237 54.2	02.8	225 52.1	55.7	222 16.2	04.0	49 19.3	22.9
03	256 48.3	252 53.9	. . 01.6	240 52.8	. . 56.4	237 18.1	. . 04.2	64 21.9	. . 22.8
04	271 50.7	267 53.6	S 00.5	255 53.5	57.2	252 20.0	04.5	79 24.5	22.8
05	286 53.2	282 53.2	N 00.7	270 54.2	57.9	267 21.9	04.7	94 27.1	22.7
06	301 55.7	297 52.9	N 0 01.9	285 54.9	N 5 58.7	282 23.8	N 7 04.9	109 29.8	S 2 22.7
07	316 58.1	312 52.6	03.0	300 55.6	5 59.4	297 25.7	05.1	124 32.4	22.6
08	332 00.6	327 52.3	04.2	315 56.3	6 00.2	312 27.6	05.4	139 35.0	22.5
S 09	347 03.1	342 51.9	. . 05.4	330 57.0	. . 00.9	327 29.5	. . 05.6	154 37.6	. . 22.5
U 10	2 05.5	357 51.6	06.5	345 57.7	01.7	342 31.4	05.8	169 40.3	22.4
N 11	17 08.0	12 51.3	07.7	0 58.3	02.4	357 33.4	06.0	184 42.9	22.3
D 12	32 10.4	27 51.0	N 0 08.9	15 59.0	N 6 03.2	12 35.3	N 7 06.2	199 45.5	S 2 22.3
A 13	47 12.9	42 50.6	10.0	30 59.7	03.9	27 37.2	06.5	214 48.1	22.2
Y 14	62 15.4	57 50.3	11.2	46 00.4	04.7	42 39.1	06.7	229 50.8	22.1
15	77 17.8	72 50.0	. . 12.4	61 01.1	. . 05.4	57 41.0	. . 06.9	244 53.4	. . 22.1
16	92 20.3	87 49.6	13.5	76 01.8	06.2	72 42.9	07.1	259 56.0	22.0
17	107 22.8	102 49.3	14.7	91 02.5	06.9	87 44.8	07.4	274 58.6	22.0
18	122 25.2	117 49.0	N 0 15.8	106 03.2	N 6 07.7	102 46.7	N 7 07.6	290 01.3	S 2 21.9
19	137 27.7	132 48.7	17.0	121 03.9	08.4	117 48.6	07.8	305 03.9	21.8
20	152 30.2	147 48.3	18.2	136 04.6	09.2	132 50.5	08.0	320 06.5	21.8
21	167 32.6	162 48.0	. . 19.3	151 05.3	. . 09.9	147 52.4	. . 08.2	335 09.1	. . 21.7
22	182 35.1	177 47.7	20.5	166 06.0	10.7	162 54.3	08.5	350 11.8	21.6
23	197 37.5	192 47.3	21.7	181 06.6	11.4	177 56.2	08.7	5 14.4	21.6
	h m								
Mer. Pass.	9 55.6	*v* −0.3	*d* 1.2	*v* 0.7	*d* 0.8	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.6
Achernar	335 28.4	S57 10.7
Acrux	173 10.5	S63 10.0
Adhara	255 13.9	S28 59.6
Aldebaran	290 51.4	N16 31.8
Alioth	166 21.4	N55 53.8
Alkaid	152 59.5	N49 15.3
Al Na'ir	27 45.8	S46 54.1
Alnilam	275 48.1	S 1 11.8
Alphard	217 57.5	S 8 42.7
Alphecca	126 12.0	N26 40.4
Alpheratz	357 45.4	N29 09.1
Altair	62 09.7	N 8 53.8
Ankaa	353 17.5	S42 14.6
Antares	112 27.9	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 30.7	S69 02.7
Avior	234 18.7	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.1	S52 42.4
Capella	280 37.1	N46 00.6
Deneb	49 32.6	N45 19.0
Denebola	182 35.0	N14 30.4
Diphda	348 57.7	S17 55.4
Dubhe	193 53.0	N61 41.4
Elnath	278 14.8	N28 37.0
Eltanin	90 46.6	N51 29.0
Enif	33 48.8	N 9 55.6
Fomalhaut	15 25.9	S29 33.6
Gacrux	172 02.2	S57 10.9
Gienah	175 53.6	S17 36.5
Hadar	148 49.5	S60 25.8
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.7	S34 22.6
Kochab	137 18.6	N74 06.4
Markab	13 40.1	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.0	S36 25.7
Miaplacidus	221 39.9	S69 46.2
Mirfak	308 43.1	N49 54.1
Nunki	76 00.1	S26 16.8
Peacock	53 21.6	S56 41.6
Pollux	243 29.7	N27 59.9
Procyon	245 01.4	N 5 11.6
Rasalhague	96 07.7	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.8	S 8 11.5
Rigil Kent.	139 53.3	S60 53.0
Sabik	102 14.1	S15 44.4
Schedar	349 42.9	N56 35.9
Shaula	96 23.7	S37 06.6
Sirius	258 35.2	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.5	S43 29.1
Vega	80 39.8	N38 47.4
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	357 21.0	10 08
Mars	344 52.4	10 57
Jupiter	340 44.9	11 13
Saturn	167 29.2	22 43

UT	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise			
									Naut.	Civil		22	23	24	25
	GHA	Dec	GHA	v	Dec	d	HP								
d h	° ′	° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
22 00	180 19.9	N12 00.4	306 06.7	6.2	S23 21.8	1.6	58.3	N 72	////	////	02 53				04 18
01	195 20.1	01.2	320 31.9	6.3	23 20.2	1.8	58.2	N 70	////	01 34	03 17			04 23	03 41
02	210 20.2	02.1	334 57.2	6.3	23 18.4	1.9	58.2	68	////	02 15	03 36		04 12	03 29	03 14
03	225 20.3	02.9	349 22.5	6.4	23 16.5	2.0	58.2	66	////	02 42	03 50	02 49	02 56	02 56	02 54
04	240 20.4	03.8	3 47.9	6.5	23 14.5	2.2	58.1	64	01 22	03 03	04 02	01 51	02 19	02 32	02 38
05	255 20.6	04.6	18 13.4	6.6	23 12.3	2.3	58.1	62	01 59	03 19	04 13	01 18	01 53	02 12	02 24
06	270 20.7	N12 05.5	32 39.0	6.6	S23 10.0	2.5	58.0	60	02 24	03 33	04 21	00 53	01 32	01 56	02 12
07	285 20.8	06.3	47 04.6	6.8	23 07.5	2.6	58.0	N 58	02 43	03 44	04 29	00 33	01 15	01 43	02 02
08	300 20.9	07.1	61 30.4	6.8	23 04.9	2.7	58.0	56	02 59	03 54	04 36	00 17	01 00	01 31	01 54
F 09	315 21.1	08.0	75 56.2	6.8	23 02.2	2.9	57.9	54	03 12	04 02	04 42	00 03	00 48	01 21	01 46
R 10	330 21.2	08.8	90 22.0	7.0	22 59.3	3.0	57.9	52	03 23	04 10	04 47	24 37	00 37	01 12	01 39
I 11	345 21.3	09.7	104 48.0	7.0	22 56.3	3.2	57.8	50	03 33	04 17	04 52	24 27	00 27	01 04	01 32
D 12	0 21.4	N12 10.5	119 14.0	7.2	S22 53.1	3.3	57.8	45	03 53	04 31	05 03	24 07	00 07	00 46	01 18
A 13	15 21.6	11.3	133 40.2	7.2	22 49.8	3.4	57.8	N 40	04 08	04 43	05 11	23 50	24 32	00 32	01 07
Y 14	30 21.7	12.2	148 06.4	7.2	22 46.4	3.5	57.7	35	04 21	04 52	05 19	23 36	24 20	00 20	00 57
15	45 21.8	13.0	162 32.6	7.4	22 42.9	3.7	57.7	30	04 31	05 00	05 25	23 23	24 09	00 09	00 49
16	60 21.9	13.9	176 59.0	7.5	22 39.2	3.8	57.6	20	04 47	05 14	05 36	23 02	23 51	24 34	00 34
17	75 22.1	14.7	191 25.5	7.5	22 35.4	3.9	57.6	N 10	04 59	05 25	05 46	22 44	23 35	24 21	00 21
18	90 22.2	N12 15.5	205 52.0	7.6	S22 31.5	4.1	57.6	0	05 09	05 34	05 55	22 27	23 20	24 09	00 09
19	105 22.3	16.4	220 18.6	7.8	22 27.4	4.2	57.5	S 10	05 18	05 42	06 04	22 10	23 05	23 56	24 45
20	120 22.4	17.2	234 45.4	7.8	22 23.2	4.3	57.5	20	05 25	05 51	06 13	21 51	22 49	23 43	24 35
21	135 22.5	18.1	249 12.2	7.8	22 18.9	4.4	57.4	30	05 31	05 59	06 24	21 30	22 30	23 28	24 24
22	150 22.7	18.9	263 39.0	8.0	22 14.5	4.6	57.4	35	05 34	06 04	06 30	21 18	22 19	23 20	24 18
23	165 22.8	19.7	278 06.0	8.1	22 09.9	4.6	57.4	40	05 37	06 09	06 37	21 04	22 07	23 09	24 11
23 00	180 22.9	N12 20.6	292 33.1	8.2	S22 05.3	4.8	57.3	45	05 40	06 14	06 44	20 47	21 52	22 58	24 02
01	195 23.0	21.4	307 00.3	8.2	22 00.5	5.0	57.3	S 50	05 43	06 21	06 54	20 26	21 34	22 43	23 52
02	210 23.1	22.2	321 27.5	8.3	21 55.5	5.0	57.3	52	05 44	06 23	06 58	20 15	21 25	22 37	23 47
03	225 23.3	23.1	335 54.8	8.5	21 50.5	5.1	57.2	54	05 45	06 26	07 03	20 04	21 16	22 29	23 42
04	240 23.4	23.9	350 22.3	8.5	21 45.4	5.3	57.2	56	05 46	06 30	07 08	19 51	21 05	22 21	23 36
05	255 23.5	24.8	4 49.8	8.6	21 40.1	5.4	57.1	58	05 47	06 33	07 14	19 36	20 53	22 11	23 29
06	270 23.6	N12 25.6	19 17.4	8.7	S21 34.7	5.5	57.1	S 60	05 48	06 37	07 21	19 18	20 38	22 00	23 21
07	285 23.7	26.4	33 45.1	8.8	21 29.2	5.6	57.1								
S 08	300 23.9	27.3	48 12.9	8.9	21 23.6	5.7	57.0								
A 09	315 24.0	28.1	62 40.8	9.0	21 17.9	5.8	57.0								
T 10	330 24.1	28.9	77 08.8	9.1	21 12.1	6.0	56.9								
U 11	345 24.2	29.8	91 36.9	9.1	21 06.1	6.0	56.9								
R 12	0 24.3	N12 30.6	106 05.0	9.3	S21 00.1	6.1	56.9								
D 13	15 24.4	31.4	120 33.3	9.4	20 54.0	6.3	56.8								
A 14	30 24.6	32.3	135 01.7	9.4	20 47.7	6.4	56.8								
Y 15	45 24.7	33.1	149 30.1	9.6	20 41.3	6.4	56.8								
16	60 24.8	33.9	163 58.7	9.6	20 34.9	6.6	56.7								
17	75 24.9	34.8	178 27.3	9.7	20 28.3	6.6	56.7								
18	90 25.0	N12 35.6	192 56.0	9.8	S20 21.7	6.8	56.6								
19	105 25.2	36.4	207 24.8	10.0	20 14.9	6.8	56.6								
20	120 25.3	37.2	221 53.8	10.0	20 08.1	7.0	56.6								
21	135 25.4	38.1	236 22.8	10.1	20 01.1	7.0	56.5								
22	150 25.5	38.9	250 51.9	10.2	19 54.1	7.2	56.5								
23	165 25.6	39.7	265 21.1	10.3	19 46.9	7.2	56.5								
24 00	180 25.7	N12 40.6	279 50.4	10.4	S19 39.7	7.3	56.4								
01	195 25.8	41.4	294 19.8	10.4	19 32.4	7.5	56.4								
02	210 26.0	42.2	308 49.2	10.6	19 24.9	7.5	56.4								
03	225 26.1	43.0	323 18.8	10.7	19 17.4	7.6	56.3								
04	240 26.2	43.9	337 48.5	10.7	19 09.8	7.6	56.3								
05	255 26.3	44.7	352 18.2	10.9	19 02.2	7.8	56.3								
06	270 26.4	N12 45.5	6 48.1	10.9	S18 54.4	7.9	56.2								
07	285 26.5	46.4	21 18.0	11.0	18 46.5	7.9	56.2								
08	300 26.6	47.2	35 48.0	11.1	18 38.6	8.0	56.2								
S 09	315 26.8	48.0	50 18.1	11.2	18 30.6	8.1	56.1								
U 10	330 26.9	48.8	64 48.3	11.3	18 22.5	8.2	56.1								
N 11	345 27.0	49.7	79 18.6	11.4	18 14.3	8.3	56.1								
D 12	0 27.1	N12 50.5	93 49.0	11.5	S18 06.0	8.3	56.0								
A 13	15 27.2	51.3	108 19.5	11.6	17 57.7	8.4	56.0								
Y 14	30 27.3	52.1	122 50.1	11.6	17 49.3	8.5	56.0								
15	45 27.4	52.9	137 20.7	11.7	17 40.8	8.6	55.9								
16	60 27.6	53.8	151 51.4	11.9	17 32.2	8.6	55.9								
17	75 27.7	54.6	166 22.3	11.9	17 23.6	8.7	55.9								
18	90 27.8	N12 55.4	180 53.2	12.0	S17 14.9	8.8	55.8								
19	105 27.9	56.2	195 24.2	12.0	17 06.1	8.9	55.8								
20	120 28.0	57.1	209 55.2	12.2	16 57.2	8.9	55.8								
21	135 28.1	57.9	224 26.4	12.3	16 48.3	9.0	55.7								
22	150 28.2	58.7	238 57.7	12.3	16 39.3	9.1	55.7								
23	165 28.3	59.5	253 29.0	12.4	S16 30.2	9.1	55.7								
	SD 15.9	d 0.8	SD	15.8		15.5									

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	22	23	24	25
°	h m	h m	h m	h m	h m	h m	h m
N 72	21 09	////	////				08 40
N 70	20 43	22 32	////			06 54	09 16
68	20 24	21 47	////		05 16	07 47	09 41
66	20 09	21 19	////	04 43	06 32	08 19	10 00
64	19 56	20 57	22 43	05 40	07 08	08 43	10 16
62	19 46	20 40	22 03	06 14	07 34	09 01	10 28
60	19 37	20 26	21 37	06 38	07 54	09 17	10 39
N 58	19 29	20 15	21 16	06 58	08 11	09 30	10 48
56	19 22	20 05	21 00	07 14	08 25	09 41	10 57
54	19 16	19 56	20 47	07 28	08 37	09 51	11 04
52	19 11	19 48	20 35	07 40	08 48	09 59	11 10
50	19 06	19 41	20 25	07 50	08 57	10 07	11 16
45	18 55	19 26	20 05	08 13	09 17	10 23	11 29
N 40	18 46	19 15	19 49	08 31	09 34	10 37	11 39
35	18 39	19 05	19 37	08 46	09 47	10 48	11 48
30	18 32	18 57	19 26	08 59	09 59	10 58	11 56
20	18 21	18 43	19 10	09 21	10 19	11 15	12 09
N 10	18 11	18 32	18 58	09 40	10 37	11 30	12 20
0	18 02	18 23	18 48	09 58	10 53	11 44	12 31
S 10	17 53	18 14	18 39	10 16	11 09	11 57	12 42
20	17 43	18 06	18 32	10 35	11 26	12 12	12 53
30	17 33	17 57	18 25	10 57	11 46	12 28	13 06
35	17 27	17 52	18 22	11 09	11 57	12 38	13 13
40	17 20	17 47	18 19	11 24	12 10	12 49	13 21
45	17 12	17 42	18 16	11 41	12 26	13 02	13 31
S 50	17 02	17 35	18 13	12 03	12 45	13 17	13 43
52	16 58	17 33	18 12	12 13	12 54	13 24	13 48
54	16 53	17 30	18 11	12 25	13 04	13 32	13 54
56	16 48	17 26	18 10	12 38	13 15	13 41	14 01
58	16 42	17 23	18 09	12 53	13 28	13 51	14 08
S 60	16 35	17 19	18 07	13 11	13 43	14 03	14 17

Day	SUN		MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00h	12h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
22	01 20	01 26	11 59	03 44	16 13	19	76
23	01 31	01 37	11 58	04 40	17 06	20	66
24	01 43	01 48	11 58	05 32	17 56	21	56

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
25 00	212 40.0	207 47.0	N 0 22.8	196 07.3	N 6 12.2	192 58.1	N 7 08.9	20 17.0	S 2 21.5
01	227 42.5	222 46.7	24.0	211 08.0	12.9	208 00.1	09.1	35 19.6	21.5
02	242 44.9	237 46.4	25.2	226 08.7	13.7	223 02.0	09.4	50 22.3	21.4
03	257 47.4	252 46.0	26.3	241 09.4	14.4	238 03.9	09.6	65 24.9	21.3
04	272 49.9	267 45.7	27.5	256 10.1	15.2	253 05.8	09.8	80 27.5	21.3
05	287 52.3	282 45.4	28.7	271 10.8	15.9	268 07.7	10.0	95 30.1	21.2
06	302 54.8	297 45.1	N 0 29.8	286 11.5	N 6 16.7	283 09.6	N 7 10.2	110 32.8	S 2 21.1
07	317 57.3	312 44.7	31.0	301 12.2	17.4	298 11.5	10.5	125 35.4	21.1
08	332 59.7	327 44.4	32.2	316 12.9	18.2	313 13.4	10.7	140 38.0	21.0
M 09	348 02.2	342 44.1	33.3	331 13.6	18.9	328 15.3	10.9	155 40.6	20.9
O 10	3 04.7	357 43.7	34.5	346 14.3	19.6	343 17.2	11.1	170 43.3	20.9
N 11	18 07.1	12 43.4	35.7	1 14.9	20.4	358 19.1	11.4	185 45.9	20.8
D 12	33 09.6	27 43.1	N 0 36.8	16 15.6	N 6 21.1	13 21.0	N 7 11.6	200 48.5	S 2 20.8
A 13	48 12.0	42 42.8	38.0	31 16.3	21.9	28 22.9	11.8	215 51.1	20.7
Y 14	63 14.5	57 42.4	39.2	46 17.0	22.6	43 24.9	12.0	230 53.8	20.6
15	78 17.0	72 42.1	40.3	61 17.7	23.4	58 26.8	12.2	245 56.4	20.6
16	93 19.4	87 41.8	41.5	76 18.4	24.1	73 28.7	12.5	260 59.0	20.5
17	108 21.9	102 41.4	42.7	91 19.1	24.9	88 30.6	12.7	276 01.6	20.4
18	123 24.4	117 41.1	N 0 43.8	106 19.8	N 6 25.6	103 32.5	N 7 12.9	291 04.2	S 2 20.4
19	138 26.8	132 40.8	45.0	121 20.5	26.4	118 34.4	13.1	306 06.9	20.3
20	153 29.3	147 40.5	46.2	136 21.2	27.1	133 36.3	13.3	321 09.5	20.3
21	168 31.8	162 40.1	47.3	151 21.9	27.9	148 38.2	13.6	336 12.1	20.2
22	183 34.2	177 39.8	48.5	166 22.6	28.6	163 40.1	13.8	351 14.7	20.1
23	198 36.7	192 39.5	49.7	181 23.2	29.3	178 42.0	14.0	6 17.4	20.1
26 00	213 39.2	207 39.2	N 0 50.8	196 23.9	N 6 30.1	193 43.9	N 7 14.2	21 20.0	S 2 20.0
01	228 41.6	222 38.8	52.0	211 24.6	30.8	208 45.8	14.5	36 22.6	19.9
02	243 44.1	237 38.5	53.2	226 25.3	31.6	223 47.8	14.7	51 25.2	19.9
03	258 46.5	252 38.2	54.3	241 26.0	32.3	238 49.7	14.9	66 27.8	19.8
04	273 49.0	267 37.8	55.5	256 26.7	33.1	253 51.6	15.1	81 30.5	19.8
05	288 51.5	282 37.5	56.7	271 27.4	33.8	268 53.5	15.3	96 33.1	19.7
06	303 53.9	297 37.2	N 0 57.8	286 28.1	N 6 34.6	283 55.4	N 7 15.6	111 35.7	S 2 19.6
07	318 56.4	312 36.9	0 59.0	301 28.8	35.3	298 57.3	15.8	126 38.3	19.6
T 08	333 58.9	327 36.5	1 00.2	316 29.5	36.0	313 59.2	16.0	141 41.0	19.5
U 09	349 01.3	342 36.2	01.3	331 30.2	36.8	329 01.1	16.2	156 43.6	19.5
E 10	4 03.8	357 35.9	02.5	346 30.9	37.5	344 03.0	16.4	171 46.2	19.4
S 11	19 06.3	12 35.5	03.7	1 31.5	38.3	359 04.9	16.7	186 48.8	19.3
D 12	34 08.7	27 35.2	N 1 04.8	16 32.2	N 6 39.0	14 06.8	N 7 16.9	201 51.4	S 2 19.3
A 13	49 11.2	42 34.9	06.0	31 32.9	39.8	29 08.7	17.1	216 54.1	19.2
Y 14	64 13.6	57 34.6	07.2	46 33.6	40.5	44 10.7	17.3	231 56.7	19.1
15	79 16.1	72 34.2	08.3	61 34.3	41.3	59 12.6	17.5	246 59.3	19.1
16	94 18.6	87 33.9	09.5	76 35.0	42.0	74 14.5	17.8	262 01.9	19.0
17	109 21.0	102 33.6	10.7	91 35.7	42.7	89 16.4	18.0	277 04.6	19.0
18	124 23.5	117 33.2	N 1 11.8	106 36.4	N 6 43.5	104 18.3	N 7 18.2	292 07.2	S 2 18.9
19	139 26.0	132 32.9	13.0	121 37.1	44.2	119 20.2	18.4	307 09.8	18.8
20	154 28.4	147 32.6	14.2	136 37.8	45.0	134 22.1	18.7	322 12.4	18.8
21	169 30.9	162 32.3	15.3	151 38.5	45.7	149 24.0	18.9	337 15.0	18.7
22	184 33.4	177 31.9	16.5	166 39.1	46.5	164 25.9	19.1	352 17.7	18.7
23	199 35.8	192 31.6	17.7	181 39.8	47.2	179 27.8	19.3	7 20.3	18.6
27 00	214 38.3	207 31.3	N 1 18.8	196 40.5	N 6 47.9	194 29.7	N 7 19.5	22 22.9	S 2 18.5
01	229 40.8	222 30.9	20.0	211 41.2	48.7	209 31.6	19.8	37 25.5	18.5
02	244 43.2	237 30.6	21.2	226 41.9	49.4	224 33.6	20.0	52 28.1	18.4
03	259 45.7	252 30.3	22.3	241 42.6	50.2	239 35.5	20.2	67 30.8	18.3
04	274 48.1	267 30.0	23.5	256 43.3	50.9	254 37.4	20.4	82 33.4	18.3
05	289 50.6	282 29.6	24.7	271 44.0	51.6	269 39.3	20.6	97 36.0	18.2
06	304 53.1	297 29.3	N 1 25.8	286 44.7	N 6 52.4	284 41.2	N 7 20.9	112 38.6	S 2 18.2
W 07	319 55.5	312 29.0	27.0	301 45.4	53.1	299 43.1	21.1	127 41.2	18.1
E 08	334 58.0	327 28.6	28.2	316 46.0	53.9	314 45.0	21.3	142 43.9	18.0
D 09	350 00.5	342 28.3	29.3	331 46.7	54.6	329 46.9	21.5	157 46.5	18.0
N 10	5 02.9	357 28.0	30.5	346 47.4	55.3	344 48.8	21.7	172 49.1	17.9
E 11	20 05.4	12 27.7	31.7	1 48.1	56.1	359 50.7	22.0	187 51.7	17.9
S 12	35 07.9	27 27.3	N 1 32.8	16 48.8	N 6 56.8	14 52.6	N 7 22.2	202 54.3	S 2 17.8
D 13	50 10.3	42 27.0	34.0	31 49.5	57.6	29 54.6	22.4	217 57.0	17.7
A 14	65 12.8	57 26.7	35.2	46 50.2	58.3	44 56.5	22.6	232 59.6	17.7
Y 15	80 15.3	72 26.3	36.3	61 50.9	59.0	59 58.4	22.8	248 02.2	17.6
16	95 17.7	87 26.0	37.5	76 51.6	6 59.8	75 00.3	23.1	263 04.8	17.6
17	110 20.2	102 25.7	38.7	91 52.3	7 00.5	90 02.2	23.3	278 07.4	17.5
18	125 22.6	117 25.3	N 1 39.8	106 53.0	N 7 01.3	105 04.1	N 7 23.5	293 10.1	S 2 17.4
19	140 25.1	132 25.0	41.0	121 53.6	02.0	120 06.0	23.7	308 12.7	17.4
20	155 27.6	147 24.7	42.2	136 54.3	02.7	135 07.9	23.9	323 15.3	17.3
21	170 30.0	162 24.4	43.3	151 55.0	03.5	150 09.8	24.2	338 17.9	17.3
22	185 32.5	177 24.0	44.5	166 55.7	04.2	165 11.7	24.4	353 20.5	17.2
23	200 35.0	192 23.7	45.7	181 56.4	05.0	180 13.6	24.6	8 23.1	17.1
	h m								
Mer. Pass.	9 43.8	*v* −0.3	*d* 1.2	*v* 0.7	*d* 0.7	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.6
Achernar	335 28.4	S57 10.7
Acrux	173 10.5	S63 10.0
Adhara	255 13.9	S28 59.6
Aldebaran	290 51.4	N16 31.8
Alioth	166 21.4	N55 53.9
Alkaid	152 59.5	N49 15.3
Al Na'ir	27 45.8	S46 54.1
Alnilam	275 48.1	S 1 11.8
Alphard	217 57.5	S 8 42.7
Alphecca	126 11.9	N26 40.4
Alpheratz	357 45.4	N29 09.1
Altair	62 09.7	N 8 53.8
Ankaa	353 17.5	S42 14.5
Antares	112 27.8	S26 27.4
Arcturus	145 56.8	N19 07.2
Atria	107 30.7	S69 02.7
Avior	234 18.7	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.1	S52 42.4
Capella	280 37.1	N46 00.6
Deneb	49 32.6	N45 19.0
Denebola	182 35.0	N14 30.4
Diphda	348 57.7	S17 55.4
Dubhe	193 53.0	N61 41.4
Elnath	278 14.8	N28 37.0
Eltanin	90 46.5	N51 29.0
Enif	33 48.7	N 9 55.6
Fomalhaut	15 25.9	S29 33.6
Gacrux	172 02.2	S57 10.9
Gienah	175 53.6	S17 36.5
Hadar	148 49.5	S60 25.8
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 18.6	N74 06.4
Markab	13 40.1	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.0	S36 25.7
Miaplacidus	221 40.0	S69 46.3
Mirfak	308 43.1	N49 54.1
Nunki	76 00.1	S26 16.8
Peacock	53 21.6	S56 41.6
Pollux	243 29.7	N27 59.9
Procyon	245 01.4	N 5 11.6
Rasalhague	96 07.6	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.8	S 8 11.5
Rigil Kent.	139 53.2	S60 53.0
Sabik	102 14.0	S15 44.4
Schedar	349 42.9	N56 35.9
Shaula	96 23.7	S37 06.6
Sirius	258 35.2	S16 44.2
Spica	158 32.6	S11 13.4
Suhail	222 53.5	S43 29.1
Vega	80 39.8	N38 47.4
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	354 00.0	10 10
Mars	342 44.8	10 54
Jupiter	340 04.8	11 04
Saturn	167 40.8	22 31

2011 APRIL 25, 26, 27 (MON., TUES., WED.)

UT	SUN			MOON					
	GHA		Dec	GHA	v	Dec	d	HP
d h	° ′		° ′	° ′	′	° ′	′	′
25 00	180 28.4		N13 00.3	268 00.4	12.5	S16 21.1	9.2	55.7
01	195 28.6		01.2	282 31.9	12.6	16 11.9	9.3	55.6
02	210 28.7		02.0	297 03.5	12.6	16 02.6	9.3	55.6
03	225 28.8	. .	02.8	311 35.1	12.8	15 53.3	9.4	55.6
04	240 28.9		03.6	326 06.9	12.8	15 43.9	9.4	55.5
05	255 29.0		04.4	340 38.7	12.9	15 34.5	9.5	55.5
06	270 29.1		N13 05.3	355 10.6	12.9	S15 25.0	9.6	55.5
07	285 29.2		06.1	9 42.5	13.1	15 15.4	9.6	55.4
08	300 29.3		06.9	24 14.6	13.1	15 05.8	9.7	55.4
M 09	315 29.4	. .	07.7	38 46.7	13.2	14 56.1	9.8	55.4
O 10	330 29.5		08.5	53 18.9	13.3	14 46.3	9.8	55.4
N 11	345 29.6		09.3	67 51.2	13.3	14 36.5	9.8	55.3
D 12	0 29.8		N13 10.2	82 23.5	13.4	S14 26.7	9.9	55.3
A 13	15 29.9		11.0	96 55.9	13.5	14 16.8	10.0	55.3
Y 14	30 30.0		11.8	111 28.4	13.6	14 06.8	10.0	55.3
15	45 30.1	. .	12.6	126 01.0	13.6	13 56.8	10.1	55.2
16	60 30.2		13.4	140 33.6	13.7	13 46.7	10.1	55.2
17	75 30.3		14.2	155 06.3	13.8	13 36.6	10.1	55.2
18	90 30.4		N13 15.0	169 39.1	13.9	S13 26.5	10.3	55.2
19	105 30.5		15.9	184 12.0	13.9	13 16.2	10.2	55.1
20	120 30.6		16.7	198 44.9	14.0	13 06.0	10.3	55.1
21	135 30.7	. .	17.5	213 17.9	14.0	12 55.7	10.4	55.1
22	150 30.8		18.3	227 50.9	14.1	12 45.3	10.4	55.1
23	165 30.9		19.1	242 24.0	14.2	12 34.9	10.4	55.0
26 00	180 31.0		N13 19.9	256 57.2	14.2	S12 24.5	10.5	55.0
01	195 31.1		20.7	271 30.4	14.3	12 14.0	10.6	55.0
02	210 31.2		21.5	286 03.7	14.4	12 03.4	10.5	55.0
03	225 31.3	. .	22.3	300 37.1	14.4	11 52.9	10.6	54.9
04	240 31.4		23.2	315 10.5	14.5	11 42.3	10.7	54.9
05	255 31.6		24.0	329 44.0	14.5	11 31.6	10.7	54.9
06	270 31.7		N13 24.8	344 17.5	14.6	S11 20.9	10.7	54.9
07	285 31.8		25.6	358 51.1	14.7	11 10.2	10.8	54.9
T 08	300 31.9		26.4	13 24.8	14.7	10 59.4	10.8	54.8
U 09	315 32.0	. .	27.2	27 58.5	14.7	10 48.6	10.9	54.8
E 10	330 32.1		28.0	42 32.2	14.8	10 37.7	10.8	54.8
S 11	345 32.2		28.8	57 06.0	14.9	10 26.9	11.0	54.8
D 12	0 32.3		N13 29.6	71 39.9	14.9	S10 15.9	10.9	54.8
A 13	15 32.4		30.4	86 13.8	15.0	10 05.0	11.0	54.7
Y 14	30 32.5		31.2	100 47.8	15.1	9 54.0	11.0	54.7
15	45 32.6	. .	32.0	115 21.9	15.0	9 43.0	11.1	54.7
16	60 32.7		32.8	129 55.9	15.2	9 31.9	11.0	54.7
17	75 32.8		33.6	144 30.1	15.1	9 20.9	11.1	54.7
18	90 32.9		N13 34.4	159 04.2	15.2	S 9 09.8	11.2	54.6
19	105 33.0		35.2	173 38.4	15.3	8 58.6	11.1	54.6
20	120 33.1		36.1	188 12.7	15.3	8 47.5	11.2	54.6
21	135 33.2	. .	36.9	202 47.0	15.4	8 36.3	11.3	54.6
22	150 33.3		37.7	217 21.4	15.4	8 25.0	11.2	54.6
23	165 33.4		38.5	231 55.8	15.4	8 13.8	11.3	54.5
27 00	180 33.5		N13 39.3	246 30.2	15.5	S 8 02.5	11.3	54.5
01	195 33.6		40.1	261 04.7	15.5	7 51.2	11.3	54.5
02	210 33.7		40.9	275 39.2	15.6	7 39.9	11.4	54.5
03	225 33.8	. .	41.7	290 13.8	15.6	7 28.5	11.3	54.5
04	240 33.9		42.5	304 48.4	15.6	7 17.2	11.4	54.5
05	255 34.0		43.3	319 23.0	15.7	7 05.8	11.4	54.5
06	270 34.1		N13 44.1	333 57.7	15.7	S 6 54.4	11.5	54.4
W 07	285 34.2		44.9	348 32.4	15.8	6 42.9	11.4	54.4
E 08	300 34.3		45.7	3 07.2	15.8	6 31.5	11.5	54.4
D 09	315 34.4	. .	46.5	17 42.0	15.8	6 20.0	11.5	54.4
N 10	330 34.5		47.3	32 16.8	15.8	6 08.5	11.5	54.4
E 11	345 34.6		48.1	46 51.6	15.9	5 57.0	11.6	54.4
S 12	0 34.7		N13 48.9	61 26.5	15.9	S 5 45.4	11.5	54.4
D 13	15 34.8		49.6	76 01.4	15.9	5 33.9	11.6	54.3
A 14	30 34.9		50.4	90 36.3	16.0	5 22.3	11.5	54.3
Y 15	45 35.0	. .	51.2	105 11.3	16.0	5 10.8	11.6	54.3
16	60 35.1		52.0	119 46.3	16.0	4 59.2	11.7	54.3
17	75 35.2		52.8	134 21.3	16.1	4 47.5	11.6	54.3
18	90 35.3		N13 53.6	148 56.4	16.0	S 4 35.9	11.6	54.3
19	105 35.3		54.4	163 31.4	16.1	4 24.3	11.7	54.3
20	120 35.4		55.2	178 06.5	16.1	4 12.6	11.6	54.3
21	135 35.5	. .	56.0	192 41.6	16.2	4 01.0	11.7	54.2
22	150 35.6		56.8	207 16.8	16.1	3 49.3	11.7	54.2
23	165 35.7		57.6	221 51.9	16.2	S 3 37.6	11.7	54.2
	SD 15.9		d 0.8	SD	15.1		14.9	14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 25	Moonrise 26	Moonrise 27	Moonrise 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	02 33	04 18	03 40	03 15	02 56
N 70	////	00 58	03 01	03 41	03 20	03 05	02 52
68	////	01 54	03 22	03 14	03 04	02 56	02 48
66	////	02 26	03 39	02 54	02 51	02 49	02 46
64	00 51	02 50	03 52	02 38	02 41	02 42	02 43
62	01 40	03 08	04 03	02 24	02 32	02 37	02 41
60	02 10	03 23	04 13	02 12	02 24	02 32	02 40
N 58	02 32	03 35	04 21	02 02	02 17	02 28	02 38
56	02 49	03 46	04 29	01 54	02 10	02 24	02 37
54	03 03	03 55	04 35	01 46	02 05	02 21	02 35
52	03 15	04 03	04 41	01 39	02 00	02 18	02 34
50	03 26	04 11	04 46	01 32	01 55	02 15	02 33
45	03 47	04 26	04 58	01 18	01 45	02 09	02 31
N 40	04 04	04 38	05 07	01 07	01 37	02 04	02 29
35	04 17	04 49	05 15	00 57	01 30	01 59	02 27
30	04 28	04 57	05 22	00 49	01 24	01 56	02 25
20	04 45	05 12	05 34	00 34	01 13	01 49	02 23
N 10	04 58	05 23	05 45	00 21	01 03	01 43	02 21
0	05 09	05 33	05 54	00 09	00 54	01 37	02 18
S 10	05 18	05 43	06 04	24 45	00 45	01 31	02 16
20	05 26	05 52	06 14	24 35	00 35	01 25	02 14
30	05 33	06 01	06 26	24 24	00 24	01 19	02 11
35	05 36	06 06	06 32	24 18	00 18	01 15	02 10
40	05 40	06 12	06 40	24 11	00 11	01 10	02 08
45	05 43	06 18	06 48	24 02	00 02	01 05	02 06
S 50	05 47	06 25	06 58	23 52	24 58	00 58	02 04
52	05 48	06 28	07 03	23 47	24 55	00 55	02 03
54	05 50	06 31	07 08	23 42	24 52	00 52	02 01
56	05 51	06 35	07 14	23 36	24 49	00 49	02 00
58	05 53	06 39	07 21	23 29	24 45	00 45	01 59
S 60	05 55	06 44	07 28	23 21	24 40	00 40	01 57

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 25	Moonset 26	Moonset 27	Moonset 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	21 28	////	////	08 40	10 51	12 44	14 30
N 70	20 58	23 14	////	09 16	11 09	12 52	14 31
68	20 37	22 08	////	09 41	11 23	12 59	14 31
66	20 20	21 34	////	10 00	11 35	13 05	14 32
64	20 06	21 09	23 19	10 16	11 44	13 09	14 33
62	19 54	20 51	22 21	10 28	11 52	13 14	14 33
60	19 44	20 35	21 50	10 39	11 59	13 17	14 33
N 58	19 36	20 23	21 27	10 48	12 05	13 20	14 34
56	19 28	20 12	21 09	10 57	12 11	13 23	14 34
54	19 22	20 02	20 55	11 04	12 16	13 26	14 34
52	19 16	19 54	20 42	11 10	12 20	13 28	14 35
50	19 10	19 46	20 31	11 16	12 24	13 30	14 35
45	18 59	19 31	20 10	11 29	12 32	13 34	14 35
N 40	18 49	19 18	19 53	11 39	12 39	13 38	14 36
35	18 41	19 08	19 40	11 48	12 45	13 41	14 36
30	18 34	18 59	19 29	11 56	12 51	13 44	14 37
20	18 22	18 45	19 11	12 09	13 00	13 49	14 37
N 10	18 11	18 33	18 58	12 20	13 08	13 53	14 38
0	18 01	18 23	18 47	12 31	13 15	13 57	14 38
S 10	17 52	18 13	18 38	12 42	13 22	14 01	14 38
20	17 41	18 04	18 30	12 53	13 30	14 05	14 39
30	17 30	17 54	18 22	13 06	13 39	14 10	14 39
35	17 23	17 49	18 19	13 13	13 44	14 12	14 39
40	17 16	17 44	18 15	13 21	13 50	14 15	14 40
45	17 07	17 37	18 12	13 31	13 56	14 19	14 40
S 50	16 57	17 30	18 08	13 43	14 04	14 23	14 40
52	16 52	17 27	18 07	13 48	14 08	14 25	14 41
54	16 46	17 23	18 05	13 54	14 12	14 27	14 41
56	16 41	17 20	18 03	14 01	14 16	14 29	14 41
58	16 34	17 16	18 02	14 08	14 21	14 32	14 41
S 60	16 27	17 11	18 00	14 17	14 27	14 35	14 42

Day	SUN Eqn. of Time 00^h	SUN Eqn. of Time 12^h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
25	01 54	01 59	11 58	06 20	18 43	22	46
26	02 04	02 09	11 58	07 05	19 26	23	37
27	02 14	02 18	11 58	07 47	20 08	24	28

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
28 00	215 37.4	207 23.4	N 1 46.8	196 57.1	N 7 05.7	195 15.6	N 7 24.8	23 25.8	S 2 17.1
01	230 39.9	222 23.0	48.0	211 57.8	06.4	210 17.5	25.0	38 28.4	17.0
02	245 42.4	237 22.7	49.2	226 58.5	07.2	225 19.4	25.3	53 31.0	17.0
03	260 44.8	252 22.4 . .	50.3	241 59.2 . .	07.9	240 21.3 . .	25.5	68 33.6 . .	16.9
04	275 47.3	267 22.0	51.5	256 59.9	08.7	255 23.2	25.7	83 36.2	16.8
05	290 49.7	282 21.7	52.7	272 00.5	09.4	270 25.1	25.9	98 38.9	16.8
06	305 52.2	297 21.4 N	1 53.8	287 01.2 N	7 10.1	285 27.0 N	7 26.1	113 41.5 S	2 16.7
07	320 54.7	312 21.1	55.0	302 01.9	10.9	300 28.9	26.4	128 44.1	16.7
T 08	335 57.1	327 20.7	56.2	317 02.6	11.6	315 30.8	26.6	143 46.7	16.6
H 09	350 59.6	342 20.4 . .	57.3	332 03.3 . .	12.3	330 32.7 . .	26.8	158 49.3 . .	16.5
U 10	6 02.1	357 20.1	58.5	347 04.0	13.1	345 34.7	27.0	173 51.9	16.5
R 11	21 04.5	12 19.7	1 59.7	2 04.7	13.8	0 36.6	27.2	188 54.6	16.4
S 12	36 07.0	27 19.4 N	2 00.8	17 05.4 N	7 14.5	15 38.5 N	7 27.5	203 57.2 S	2 16.4
D 13	51 09.5	42 19.1	02.0	32 06.1	15.3	30 40.4	27.7	218 59.8	16.3
A 14	66 11.9	57 18.7	03.2	47 06.8	16.0	45 42.3	27.9	234 02.4	16.2
Y 15	81 14.4	72 18.4 . .	04.3	62 07.4 . .	16.8	60 44.2 . .	28.1	249 05.0 . .	16.2
16	96 16.9	87 18.1	05.5	77 08.1	17.5	75 46.1	28.3	264 07.7	16.1
17	111 19.3	102 17.7	06.7	92 08.8	18.2	90 48.0	28.5	279 10.3	16.1
18	126 21.8	117 17.4 N	2 07.8	107 09.5 N	7 19.0	105 49.9 N	7 28.8	294 12.9 S	2 16.0
19	141 24.2	132 17.1	09.0	122 10.2	19.7	120 51.8	29.0	309 15.5	15.9
20	156 26.7	147 16.8	10.2	137 10.9	20.4	135 53.8	29.2	324 18.1	15.9
21	171 29.2	162 16.4 . .	11.3	152 11.6 . .	21.2	150 55.7 . .	29.4	339 20.7 . .	15.8
22	186 31.6	177 16.1	12.5	167 12.3	21.9	165 57.6	29.6	354 23.4	15.8
23	201 34.1	192 15.8	13.7	182 13.0	22.6	180 59.5	29.9	9 26.0	15.7
29 00	216 36.6	207 15.4 N	2 14.8	197 13.6 N	7 23.4	196 01.4 N	7 30.1	24 28.6 S	2 15.6
01	231 39.0	222 15.1	16.0	212 14.3	24.1	211 03.3	30.3	39 31.2	15.6
02	246 41.5	237 14.8	17.2	227 15.0	24.8	226 05.2	30.5	54 33.8	15.5
03	261 44.0	252 14.4 . .	18.3	242 15.7 . .	25.6	241 07.1 . .	30.7	69 36.4 . .	15.5
04	276 46.4	267 14.1	19.5	257 16.4	26.3	256 09.0	31.0	84 39.0	15.4
05	291 48.9	282 13.8	20.7	272 17.1	27.1	271 10.9	31.2	99 41.7	15.4
06	306 51.3	297 13.4 N	2 21.8	287 17.8 N	7 27.8	286 12.9 N	7 31.4	114 44.3 S	2 15.3
07	321 53.8	312 13.1	23.0	302 18.5	28.5	301 14.8	31.6	129 46.9	15.2
08	336 56.3	327 12.8	24.2	317 19.2	29.3	316 16.7	31.8	144 49.5	15.2
F 09	351 58.7	342 12.4 . .	25.3	332 19.9 . .	30.0	331 18.6 . .	32.1	159 52.1 . .	15.1
R 10	7 01.2	357 12.1	26.5	347 20.5	30.7	346 20.5	32.3	174 54.7	15.1
I 11	22 03.7	12 11.8	27.7	2 21.2	31.5	1 22.4	32.5	189 57.4	15.0
D 12	37 06.1	27 11.4 N	2 28.8	17 21.9 N	7 32.2	16 24.3 N	7 32.7	205 00.0 S	2 14.9
A 13	52 08.6	42 11.1	30.0	32 22.6	32.9	31 26.2	32.9	220 02.6	14.9
Y 14	67 11.1	57 10.8	31.2	47 23.3	33.7	46 28.1	33.1	235 05.2	14.8
15	82 13.5	72 10.4 . .	32.3	62 24.0 . .	34.4	61 30.1 . .	33.4	250 07.8 . .	14.8
16	97 16.0	87 10.1	33.5	77 24.7	35.1	76 32.0	33.6	265 10.4	14.7
17	112 18.5	102 09.8	34.7	92 25.4	35.8	91 33.9	33.8	280 13.1	14.6
18	127 20.9	117 09.4 N	2 35.8	107 26.1 N	7 36.6	106 35.8 N	7 34.0	295 15.7 S	2 14.6
19	142 23.4	132 09.1	37.0	122 26.7	37.3	121 37.7	34.2	310 18.3	14.5
20	157 25.8	147 08.8	38.2	137 27.4	38.0	136 39.6	34.5	325 20.9	14.5
21	172 28.3	162 08.5 . .	39.3	152 28.1 . .	38.8	151 41.5 . .	34.7	340 23.5 . .	14.4
22	187 30.8	177 08.1	40.5	167 28.8	39.5	166 43.4	34.9	355 26.1	14.4
23	202 33.2	192 07.8	41.7	182 29.5	40.2	181 45.3	35.1	10 28.7	14.3
30 00	217 35.7	207 07.5 N	2 42.8	197 30.2 N	7 41.0	196 47.3 N	7 35.3	25 31.4 S	2 14.2
01	232 38.2	222 07.1	44.0	212 30.9	41.7	211 49.2	35.5	40 34.0	14.2
02	247 40.6	237 06.8	45.2	227 31.6	42.4	226 51.1	35.8	55 36.6	14.1
03	262 43.1	252 06.5 . .	46.3	242 32.3 . .	43.2	241 53.0 . .	36.0	70 39.2 . .	14.1
04	277 45.6	267 06.1	47.5	257 32.9	43.9	256 54.9	36.2	85 41.8	14.0
05	292 48.0	282 05.8	48.7	272 33.6	44.6	271 56.8	36.4	100 44.4	14.0
06	307 50.5	297 05.4 N	2 49.8	287 34.3 N	7 45.4	286 58.7 N	7 36.6	115 47.0 S	2 13.9
07	322 53.0	312 05.1	51.0	302 35.0	46.1	302 00.6	36.9	130 49.6	13.8
S 08	337 55.4	327 04.8	52.2	317 35.7	46.8	317 02.5	37.1	145 52.3	13.8
A 09	352 57.9	342 04.4 . .	53.3	332 36.4 . .	47.5	332 04.5 . .	37.3	160 54.9 . .	13.7
T 10	8 00.3	357 04.1	54.5	347 37.1	48.3	347 06.4	37.5	175 57.5	13.7
U 11	23 02.8	12 03.8	55.7	2 37.8	49.0	2 08.3	37.7	191 00.1	13.6
R 12	38 05.3	27 03.4 N	2 56.8	17 38.4 N	7 49.7	17 10.2 N	7 37.9	206 02.7 S	2 13.6
D 13	53 07.7	42 03.1	58.0	32 39.1	50.5	32 12.1	38.2	221 05.3	13.5
A 14	68 10.2	57 02.8	2 59.2	47 39.8	51.2	47 14.0	38.4	236 07.9	13.4
Y 15	83 12.7	72 02.4	3 00.3	62 40.5 . .	51.9	62 15.9 . .	38.6	251 10.6 . .	13.4
16	98 15.1	87 02.1	01.5	77 41.2	52.7	77 17.8	38.8	266 13.2	13.3
17	113 17.6	102 01.8	02.6	92 41.9	53.4	92 19.7	39.0	281 15.8	13.3
18	128 20.1	117 01.4 N	3 03.8	107 42.6 N	7 54.1	107 21.7 N	7 39.2	296 18.4 S	2 13.2
19	143 22.5	132 01.1	05.0	122 43.3	54.8	122 23.6	39.5	311 21.0	13.2
20	158 25.0	147 00.8	06.1	137 44.0	55.6	137 25.5	39.7	326 23.6	13.1
21	173 27.4	162 00.4 . .	07.3	152 44.6 . .	56.3	152 27.4 . .	39.9	341 26.2 . .	13.0
22	188 29.9	177 00.1	08.5	167 45.3	57.0	167 29.3	40.1	356 28.8	13.0
23	203 32.4	191 59.8	09.6	182 46.0	57.7	182 31.2	40.3	11 31.5	12.9
	h m								
Mer. Pass.	9 32.0	v −0.3	d 1.2	v 0.7	d 0.7	v 1.9	d 0.2	v 2.6	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.6
Achernar	335 28.4	S57 10.7
Acrux	173 10.5	S63 10.0
Adhara	255 13.9	S28 59.6
Aldebaran	290 51.4	N16 31.8
Alioth	166 21.4	N55 53.9
Alkaid	152 59.5	N49 15.3
Al Na'ir	27 45.8	S46 54.1
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.5	S 8 42.7
Alphecca	126 11.9	N26 40.4
Alpheratz	357 45.4	N29 09.1
Altair	62 09.7	N 8 53.8
Ankaa	353 17.5	S42 14.5
Antares	112 27.8	S26 27.4
Arcturus	145 56.8	N19 07.3
Atria	107 30.6	S69 02.7
Avior	234 18.8	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.1	S52 42.4
Capella	280 37.1	N46 00.6
Deneb	49 32.6	N45 19.0
Denebola	182 35.0	N14 30.4
Diphda	348 57.7	S17 55.4
Dubhe	193 53.1	N61 41.5
Elnath	278 14.8	N28 37.0
Eltanin	90 46.5	N51 29.0
Enif	33 48.7	N 9 55.6
Fomalhaut	15 25.8	S29 33.6
Gacrux	172 02.2	S57 10.9
Gienah	175 53.6	S17 36.5
Hadar	148 49.5	S60 25.8
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 18.6	N74 06.4
Markab	13 40.1	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.0	S36 25.7
Miaplacidus	221 40.0	S69 46.3
Mirfak	308 43.1	N49 54.1
Nunki	76 00.0	S26 16.8
Peacock	53 21.5	S56 41.6
Pollux	243 29.7	N27 59.9
Procyon	245 01.4	N 5 11.6
Rasalhague	96 07.6	N12 33.0
Regulus	207 45.0	N11 54.5
Rigel	281 13.8	S 8 11.5
Rigil Kent.	139 53.2	S60 53.0
Sabik	102 14.0	S15 44.3
Schedar	349 42.9	N56 35.9
Shaula	96 23.7	S37 06.6
Sirius	258 35.2	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.6	S43 29.1
Vega	80 39.8	N38 47.5
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	350 38.9	10 11
Mars	340 37.1	10 51
Jupiter	339 24.8	10 55
Saturn	167 52.0	22 18

UT	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise			
									Naut.	Civil		28	29	30	1
	GHA	Dec	GHA	v	Dec	d	HP								
d h	° ′	° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
28 00	180 35.8	N13 58.4	236 27.1	16.2	S 3 25.9	11.7	54.2	N 72	////	////	02 11	02 56	02 37	02 18	01 56
01	195 35.9	13 59.2	251 02.3	16.2	3 14.2	11.7	54.2	N 70	////	////	02 45	02 52	02 39	02 27	02 13
02	210 36.0	14 00.0	265 37.5	16.3	3 02.5	11.7	54.2	68	////	01 30	03 08	02 48	02 41	02 34	02 26
03	225 36.1	. . 00.8	280 12.8	16.2	2 50.8	11.7	54.2	66	////	02 10	03 27	02 46	02 43	02 40	02 37
04	240 36.2	01.6	294 48.0	16.3	2 39.1	11.8	54.2	64	////	02 36	03 42	02 43	02 44	02 45	02 47
05	255 36.3	02.3	309 23.3	16.3	2 27.3	11.7	54.2	62	01 20	02 56	03 54	02 41	02 45	02 50	02 55
06	270 36.4	N14 03.1	323 58.6	16.3	S 2 15.6	11.8	54.2	60	01 55	03 13	04 05	02 40	02 46	02 53	03 02
07	285 36.5	03.9	338 33.9	16.3	2 03.8	11.7	54.1	N 58	02 20	03 26	04 14	02 38	02 47	02 57	03 08
08	300 36.6	04.7	353 09.2	16.3	1 52.1	11.8	54.1	56	02 39	03 38	04 22	02 37	02 48	03 00	03 13
09	315 36.7	. . 05.5	7 44.5	16.3	1 40.3	11.7	54.1	54	02 54	03 48	04 29	02 35	02 49	03 03	03 18
10	330 36.8	06.3	22 19.8	16.4	1 28.6	11.8	54.1	52	03 07	03 57	04 35	02 34	02 50	03 05	03 23
11	345 36.8	07.1	36 55.2	16.3	1 16.8	11.7	54.1	50	03 19	04 05	04 41	02 33	02 50	03 08	03 27
12	0 36.9	N14 07.9	51 30.5	16.4	S 1 05.1	11.8	54.1	45	03 41	04 21	04 53	02 31	02 52	03 13	03 36
13	15 37.0	08.6	66 05.9	16.3	0 53.3	11.8	54.1	N 40	03 59	04 34	05 03	02 29	02 53	03 17	03 43
14	30 37.1	09.4	80 41.2	16.4	0 41.5	11.7	54.1	35	04 13	04 45	05 12	02 27	02 54	03 21	03 49
15	45 37.2	. . 10.2	95 16.6	16.4	0 29.8	11.8	54.1	30	04 24	04 54	05 19	02 25	02 55	03 24	03 55
16	60 37.3	11.0	109 52.0	16.3	0 18.0	11.8	54.1	20	04 42	05 09	05 32	02 23	02 56	03 30	04 05
17	75 37.4	11.8	124 27.3	16.4	S 0 06.2	11.7	54.1	N 10	04 56	05 22	05 44	02 21	02 58	03 35	04 13
18	90 37.5	N14 12.6	139 02.7	16.4	N 0 05.5	11.8	54.1	0	05 08	05 33	05 54	02 18	02 59	03 40	04 21
19	105 37.6	13.4	153 38.1	16.4	0 17.3	11.8	54.1	S 10	05 18	05 43	06 04	02 16	03 00	03 44	04 30
20	120 37.7	14.1	168 13.5	16.4	0 29.1	11.7	54.1	20	05 26	05 52	06 15	02 14	03 02	03 50	04 38
21	135 37.8	. . 14.9	182 48.9	16.4	0 40.8	11.8	54.1	30	05 34	06 03	06 27	02 11	03 03	03 56	04 49
22	150 37.8	15.7	197 24.3	16.4	0 52.6	11.7	54.0	35	05 38	06 08	06 35	02 10	03 04	03 59	04 54
23	165 37.9	16.5	211 59.7	16.4	1 04.3	11.8	54.0	40	05 42	06 14	06 43	02 08	03 05	04 03	05 01
29 00	180 38.0	N14 17.3	226 35.1	16.4	N 1 16.1	11.7	54.0	45	05 47	06 21	06 52	02 06	03 07	04 08	05 09
01	195 38.1	18.1	241 10.5	16.3	1 27.8	11.7	54.0	S 50	05 51	06 29	07 03	02 04	03 08	04 13	05 18
02	210 38.2	18.8	255 45.8	16.4	1 39.5	11.8	54.0	52	05 53	06 33	07 08	02 03	03 09	04 16	05 23
03	225 38.3	. . 19.6	270 21.2	16.4	1 51.3	11.7	54.0	54	05 55	06 36	07 14	02 01	03 10	04 18	05 28
04	240 38.4	20.4	284 56.6	16.4	2 03.0	11.7	54.0	56	05 56	06 41	07 20	02 00	03 11	04 21	05 33
05	255 38.5	21.2	299 32.0	16.3	2 14.7	11.7	54.0	58	05 59	06 45	07 27	01 59	03 12	04 25	05 39
06	270 38.6	N14 22.0	314 07.3	16.4	N 2 26.4	11.7	54.0	S 60	06 01	06 50	07 35	01 57	03 13	04 29	05 46
07	285 38.6	22.7	328 42.7	16.3	2 38.1	11.7	54.0								
08	300 38.7	23.5	343 18.0	16.3	2 49.8	11.6	54.0								
09	315 38.8	. . 24.3	357 53.3	16.4	3 01.4	11.7	54.0								
10	330 38.9	25.1	12 28.7	16.3	3 13.1	11.7	54.0								
11	345 39.0	25.9	27 04.0	16.3	3 24.8	11.6	54.0								
12	0 39.1	N14 26.6	41 39.3	16.3	N 3 36.4	11.6	54.0								
13	15 39.2	27.4	56 14.6	16.3	3 48.0	11.6	54.0								
14	30 39.2	28.2	70 49.9	16.2	3 59.6	11.6	54.0								
15	45 39.3	. . 29.0	85 25.1	16.3	4 11.2	11.6	54.0								
16	60 39.4	29.7	100 00.4	16.2	4 22.8	11.5	54.0								
17	75 39.5	30.5	114 35.6	16.2	4 34.3	11.6	54.0								
18	90 39.6	N14 31.3	129 10.8	16.2	N 4 45.9	11.5	54.0								
19	105 39.7	32.1	143 46.0	16.2	4 57.4	11.5	54.0								
20	120 39.8	32.8	158 21.2	16.1	5 08.9	11.5	54.0								
21	135 39.8	. . 33.6	172 56.3	16.2	5 20.4	11.5	54.0								
22	150 39.9	34.4	187 31.5	16.1	5 31.9	11.4	54.0								
23	165 40.0	35.2	202 06.6	16.1	5 43.3	11.5	54.0								
30 00	180 40.1	N14 35.9	216 41.7	16.1	N 5 54.8	11.4	54.0								
01	195 40.2	36.7	231 16.8	16.0	6 06.2	11.4	54.0								
02	210 40.3	37.5	245 51.8	16.0	6 17.6	11.3	54.0								
03	225 40.3	. . 38.3	260 26.8	16.0	6 28.9	11.4	54.0								
04	240 40.4	39.0	275 01.8	16.0	6 40.3	11.3	54.0								
05	255 40.5	39.8	289 36.8	16.0	6 51.6	11.3	54.0								
06	270 40.6	N14 40.6	304 11.8	15.9	N 7 02.9	11.3	54.0								
07	285 40.7	41.3	318 46.7	15.9	7 14.2	11.2	54.0								
08	300 40.8	42.1	333 21.6	15.8	7 25.4	11.2	54.0								
09	315 40.8	. . 42.9	347 56.4	15.9	7 36.6	11.2	54.0								
10	330 40.9	43.6	2 31.3	15.8	7 47.8	11.2	54.0								
11	345 41.0	44.4	17 06.1	15.7	7 59.0	11.1	54.0								
12	0 41.1	N14 45.2	31 40.8	15.8	N 8 10.1	11.1	54.0								
13	15 41.2	45.9	46 15.6	15.7	8 21.2	11.1	54.0								
14	30 41.2	46.7	60 50.3	15.7	8 32.3	11.1	54.0								
15	45 41.3	. . 47.5	75 25.0	15.6	8 43.4	11.0	54.0								
16	60 41.4	48.2	89 59.6	15.6	8 54.4	11.0	54.1								
17	75 41.5	49.0	104 34.2	15.6	9 05.4	10.9	54.1								
18	90 41.6	N14 49.8	119 08.8	15.5	N 9 16.3	10.9	54.1								
19	105 41.6	50.5	133 43.3	15.5	9 27.2	10.9	54.1								
20	120 41.7	51.3	148 17.8	15.5	9 38.1	10.8	54.1								
21	135 41.8	. . 52.1	162 52.3	15.4	9 48.9	10.9	54.1								
22	150 41.9	52.8	177 26.7	15.4	9 59.8	10.7	54.1								
23	165 42.0	53.6	192 01.1	15.3	N10 10.5	10.8	54.1								
	SD 15.9	d 0.8	SD	14.7		14.7	14.7								

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	28	29	30	1
°	h m	h m	h m	h m	h m	h m	h m
N 72	21 50	////	////	14 30	16 14	18 03	20 03
N 70	21 14	////	////	14 31	16 08	17 48	19 35
68	20 50	22 32	////	14 31	16 03	17 36	19 14
66	20 31	21 50	////	14 32	15 59	17 27	18 57
64	20 15	21 22	////	14 33	15 55	17 18	18 44
62	20 03	21 01	22 42	14 33	15 52	17 12	18 33
60	19 52	20 44	22 04	14 33	15 49	17 06	18 23
N 58	19 43	20 30	21 38	14 34	15 47	17 00	18 15
56	19 35	20 19	21 19	14 34	15 45	16 56	18 08
54	19 27	20 08	21 03	14 34	15 43	16 52	18 01
52	19 21	19 59	20 49	14 35	15 41	16 48	17 55
50	19 15	19 51	20 38	14 35	15 39	16 44	17 50
45	19 03	19 35	20 14	14 35	15 36	16 37	17 39
N 40	18 52	19 21	19 57	14 36	15 33	16 31	17 30
35	18 43	19 10	19 43	14 36	15 31	16 26	17 22
30	18 36	19 01	19 31	14 37	15 29	16 21	17 15
20	18 23	18 46	19 13	14 37	15 25	16 13	17 03
N 10	18 11	18 33	18 59	14 38	15 22	16 06	16 52
0	18 01	18 22	18 47	14 38	15 18	16 00	16 42
S 10	17 50	18 12	18 37	14 38	15 15	15 53	16 32
20	17 39	18 02	18 28	14 39	15 12	15 46	16 22
30	17 27	17 52	18 20	14 39	15 08	15 38	16 10
35	17 20	17 46	18 16	14 39	15 06	15 34	16 03
40	17 12	17 40	18 12	14 40	15 04	15 29	15 56
45	17 02	17 33	18 08	14 40	15 01	15 23	15 47
S 50	16 51	17 25	18 03	14 40	14 58	15 16	15 36
52	16 46	17 21	18 01	14 41	14 56	15 13	15 31
54	16 40	17 18	17 59	14 41	14 55	15 09	15 25
56	16 34	17 13	17 57	14 41	14 53	15 05	15 19
58	16 27	17 09	17 55	14 41	14 51	15 01	15 13
S 60	16 19	17 04	17 53	14 42	14 48	14 56	15 05

Day	SUN			MOON				
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00h	12h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
28	02 23	02 28	11 58	08 28	20 48	25	20
29	02 32	02 36	11 57	09 09	21 29	26	13
30	02 40	02 44	11 57	09 50	22 11	27	7

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.5	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1 00	218 34.8	206 59.4	N 3 10.8	197 46.7	N 7 58.5	197 33.1	N 7 40.5	26 34.1	S 2 12.9
01	233 37.3	221 59.1	12.0	212 47.4	59.2	212 35.0	40.8	41 36.7	12.8
02	248 39.8	236 58.8	13.1	227 48.1	7 59.9	227 37.0	41.0	56 39.3	12.8
03	263 42.2	251 58.4	. . 14.3	242 48.8	8 00.7	242 38.9	. . 41.2	71 41.9	. . 12.7
04	278 44.7	266 58.1	15.5	257 49.5	01.4	257 40.8	41.4	86 44.5	12.6
05	293 47.2	281 57.7	16.6	272 50.1	02.1	272 42.7	41.6	101 47.1	12.6
06	308 49.6	296 57.4	N 3 17.8	287 50.8	N 8 02.8	287 44.6	N 7 41.9	116 49.7	S 2 12.5
07	323 52.1	311 57.1	18.9	302 51.5	03.6	302 46.5	42.1	131 52.3	12.5
08	338 54.6	326 56.7	20.1	317 52.2	04.3	317 48.4	42.3	146 55.0	12.4
S 09	353 57.0	341 56.4	. . 21.3	332 52.9	. . 05.0	332 50.3	. . 42.5	161 57.6	. . 12.4
U 10	8 59.5	356 56.1	22.4	347 53.6	05.7	347 52.3	42.7	177 00.2	12.3
N 11	24 01.9	11 55.7	23.6	2 54.3	06.5	2 54.2	42.9	192 02.8	12.2
D 12	39 04.4	26 55.4	N 3 24.8	17 55.0	N 8 07.2	17 56.1	N 7 43.2	207 05.4	S 2 12.2
A 13	54 06.9	41 55.1	25.9	32 55.6	07.9	32 58.0	43.4	222 08.0	12.1
Y 14	69 09.3	56 54.7	27.1	47 56.3	08.6	47 59.9	43.6	237 10.6	12.1
15	84 11.8	71 54.4	. . 28.3	62 57.0	. . 09.4	63 01.8	. . 43.8	252 13.2	. . 12.0
16	99 14.3	86 54.0	29.4	77 57.7	10.1	78 03.7	44.0	267 15.8	12.0
17	114 16.7	101 53.7	30.6	92 58.4	10.8	93 05.6	44.2	282 18.5	11.9
18	129 19.2	116 53.4	N 3 31.7	107 59.1	N 8 11.5	108 07.6	N 7 44.5	297 21.1	S 2 11.9
19	144 21.7	131 53.0	32.9	122 59.8	12.3	123 09.5	44.7	312 23.7	11.8
20	159 24.1	146 52.7	34.1	138 00.5	13.0	138 11.4	44.9	327 26.3	11.7
21	174 26.6	161 52.4	. . 35.2	153 01.1	. . 13.7	153 13.3	. . 45.1	342 28.9	. . 11.7
22	189 29.0	176 52.0	36.4	168 01.8	14.4	168 15.2	45.3	357 31.5	11.6
23	204 31.5	191 51.7	37.6	183 02.5	15.2	183 17.1	45.5	12 34.1	11.6
2 00	219 34.0	206 51.3	N 3 38.7	198 03.2	N 8 15.9	198 19.0	N 7 45.8	27 36.7	S 2 11.5
01	234 36.4	221 51.0	39.9	213 03.9	16.6	213 20.9	46.0	42 39.3	11.5
02	249 38.9	236 50.7	41.0	228 04.6	17.3	228 22.9	46.2	57 41.9	11.4
03	264 41.4	251 50.3	. . 42.2	243 05.3	. . 18.1	243 24.8	. . 46.4	72 44.6	. . 11.4
04	279 43.8	266 50.0	43.4	258 06.0	18.8	258 26.7	46.6	87 47.2	11.3
05	294 46.3	281 49.6	44.5	273 06.6	19.5	273 28.6	46.8	102 49.8	11.2
06	309 48.8	296 49.3	N 3 45.7	288 07.3	N 8 20.2	288 30.5	N 7 47.0	117 52.4	S 2 11.2
07	324 51.2	311 49.0	46.9	303 08.0	20.9	303 32.4	47.3	132 55.0	11.1
08	339 53.7	326 48.6	48.0	318 08.7	21.7	318 34.3	47.5	147 57.6	11.1
M 09	354 56.2	341 48.3	. . 49.2	333 09.4	. . 22.4	333 36.2	. . 47.7	163 00.2	. . 11.0
O 10	9 58.6	356 48.0	50.3	348 10.1	23.1	348 38.2	47.9	178 02.8	11.0
N 11	25 01.1	11 47.6	51.5	3 10.8	23.8	3 40.1	48.1	193 05.4	10.9
D 12	40 03.5	26 47.3	N 3 52.7	18 11.4	N 8 24.6	18 42.0	N 7 48.3	208 08.0	S 2 10.9
A 13	55 06.0	41 46.9	53.8	33 12.1	25.3	33 43.9	48.6	223 10.6	10.8
Y 14	70 08.5	56 46.6	55.0	48 12.8	26.0	48 45.8	48.8	238 13.3	10.7
15	85 10.9	71 46.3	. . 56.1	63 13.5	. . 26.7	63 47.7	. . 49.0	253 15.9	. . 10.7
16	100 13.4	86 45.9	57.3	78 14.2	27.4	78 49.6	49.2	268 18.5	10.6
17	115 15.9	101 45.6	58.5	93 14.9	28.2	93 51.6	49.4	283 21.1	10.6
18	130 18.3	116 45.2	N 3 59.6	108 15.6	N 8 28.9	108 53.5	N 7 49.6	298 23.7	S 2 10.5
19	145 20.8	131 44.9	4 00.8	123 16.3	29.6	123 55.4	49.9	313 26.3	10.5
20	160 23.3	146 44.6	02.0	138 16.9	30.3	138 57.3	50.1	328 28.9	10.4
21	175 25.7	161 44.2	. . 03.1	153 17.6	. . 31.0	153 59.2	. . 50.3	343 31.5	. . 10.4
22	190 28.2	176 43.9	04.3	168 18.3	31.8	169 01.1	50.5	358 34.1	10.3
23	205 30.7	191 43.5	05.4	183 19.0	32.5	184 03.0	50.7	13 36.7	10.3
3 00	220 33.1	206 43.2	N 4 06.6	198 19.7	N 8 33.2	199 05.0	N 7 50.9	28 39.3	S 2 10.2
01	235 35.6	221 42.8	07.8	213 20.4	33.9	214 06.9	51.1	43 41.9	10.1
02	250 38.0	236 42.5	08.9	228 21.1	34.6	229 08.8	51.4	58 44.5	10.1
03	265 40.5	251 42.2	. . 10.1	243 21.7	. . 35.4	244 10.7	. . 51.6	73 47.2	. . 10.0
04	280 43.0	266 41.8	11.2	258 22.4	36.1	259 12.6	51.8	88 49.8	10.0
05	295 45.4	281 41.5	12.4	273 23.1	36.8	274 14.5	52.0	103 52.4	09.9
06	310 47.9	296 41.1	N 4 13.6	288 23.8	N 8 37.5	289 16.4	N 7 52.2	118 55.0	S 2 09.9
07	325 50.4	311 40.8	14.7	303 24.5	38.2	304 18.4	52.4	133 57.6	09.8
T 08	340 52.8	326 40.5	15.9	318 25.2	39.0	319 20.3	52.7	149 00.2	09.8
U 09	355 55.3	341 40.1	. . 17.0	333 25.9	. . 39.7	334 22.2	. . 52.9	164 02.8	. . 09.7
E 10	10 57.8	356 39.8	18.2	348 26.5	40.4	349 24.1	53.1	179 05.4	09.7
S 11	26 00.2	11 39.4	19.3	3 27.2	41.1	4 26.0	53.3	194 08.0	09.6
D 12	41 02.7	26 39.1	N 4 20.5	18 27.9	N 8 41.8	19 27.9	N 7 53.5	209 10.6	S 2 09.6
A 13	56 05.1	41 38.7	21.7	33 28.6	42.5	34 29.8	53.7	224 13.2	09.5
Y 14	71 07.6	56 38.4	22.8	48 29.3	43.3	49 31.8	53.9	239 15.8	09.4
15	86 10.1	71 38.1	. . 24.0	63 30.0	. . 44.0	64 33.7	. . 54.2	254 18.4	. . 09.4
16	101 12.5	86 37.7	25.1	78 30.7	44.7	79 35.6	54.4	269 21.0	09.3
17	116 15.0	101 37.4	26.3	93 31.3	45.4	94 37.5	54.6	284 23.6	09.3
18	131 17.5	116 37.0	N 4 27.5	108 32.0	N 8 46.1	109 39.4	N 7 54.8	299 26.2	S 2 09.2
19	146 19.9	131 36.7	28.6	123 32.7	46.8	124 41.3	55.0	314 28.9	09.2
20	161 22.4	146 36.3	29.8	138 33.4	47.6	139 43.2	55.2	329 31.5	09.1
21	176 24.9	161 36.0	. . 30.9	153 34.1	. . 48.3	154 45.2	. . 55.4	344 34.1	. . 09.1
22	191 27.3	176 35.7	32.1	168 34.8	49.0	169 47.1	55.7	359 36.7	09.0
23	206 29.8	191 35.3	33.2	183 35.5	49.7	184 49.0	55.9	14 39.3	09.0
	h m								
Mer. Pass.	9 20.2	*v* −0.3	*d* 1.2	*v* 0.7	*d* 0.7	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.6
Achernar	335 28.4	S57 10.6
Acrux	173 10.5	S63 10.0
Adhara	255 13.9	S28 59.5
Aldebaran	290 51.5	N16 31.8
Alioth	166 21.4	N55 53.9
Alkaid	152 59.6	N49 15.3
Al Na'ir	27 45.7	S46 54.1
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.5
Alpheratz	357 45.4	N29 09.1
Altair	62 09.6	N 8 53.8
Ankaa	353 17.5	S42 14.5
Antares	112 27.8	S26 27.4
Arcturus	145 56.8	N19 07.3
Atria	107 30.6	S69 02.7
Avior	234 18.8	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.2	S52 42.4
Capella	280 37.1	N46 00.6
Deneb	49 32.5	N45 19.0
Denebola	182 35.0	N14 30.4
Diphda	348 57.7	S17 55.4
Dubhe	193 53.1	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.5	N51 29.0
Enif	33 48.7	N 9 55.6
Fomalhaut	15 25.8	S29 33.6
Gacrux	172 02.2	S57 10.9
Gienah	175 53.6	S17 36.6
Hadar	148 49.5	S60 25.8
Hamal	328 02.9	N23 30.9
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 18.6	N74 06.5
Markab	13 40.1	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.0	S36 25.7
Miaplacidus	221 40.1	S69 46.3
Mirfak	308 43.1	N49 54.1
Nunki	76 00.0	S26 16.8
Peacock	53 21.5	S56 41.6
Pollux	243 29.7	N27 59.9
Procyon	245 01.4	N 5 11.6
Rasalhague	96 07.6	N12 33.0
Regulus	207 45.0	N11 54.6
Rigel	281 13.8	S 8 11.5
Rigil Kent.	139 53.2	S60 53.0
Sabik	102 14.0	S15 44.3
Schedar	349 42.9	N56 35.9
Shaula	96 23.7	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.6	S43 29.1
Vega	80 39.8	N38 47.5
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	347 17.4	10 13
Mars	338 29.2	10 47
Jupiter	338 45.1	10 45
Saturn	168 02.8	22 06

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
1 00	180 42.0	N14 54.4	206 35.4	15.3	N10 21.3	10.7	54.1
01	195 42.1	55.1	221 09.7	15.3	10 32.0	10.6	54.1
02	210 42.2	55.9	235 44.0	15.2	10 42.6	10.6	54.1
03	225 42.3	. . 56.6	250 18.2	15.2	10 53.2	10.6	54.1
04	240 42.3	57.4	264 52.4	15.1	11 03.8	10.6	54.1
05	255 42.4	58.2	279 26.5	15.1	11 14.4	10.5	54.1
06	270 42.5	N14 58.9	294 00.6	15.1	N11 24.9	10.4	54.1
07	285 42.6	14 59.7	308 34.7	15.0	11 35.3	10.4	54.1
08	300 42.6	15 00.4	323 08.7	15.0	11 45.7	10.4	54.1
S 09	315 42.7	. . 01.2	337 42.7	14.9	11 56.1	10.3	54.2
U 10	330 42.8	02.0	352 16.6	14.8	12 06.4	10.3	54.2
N 11	345 42.9	02.7	6 50.4	14.9	12 16.7	10.2	54.2
D 12	0 42.9	N15 03.5	21 24.3	14.7	N12 26.9	10.2	54.2
A 13	15 43.0	04.2	35 58.0	14.8	12 37.1	10.1	54.2
Y 14	30 43.1	05.0	50 31.8	14.6	12 47.2	10.1	54.2
15	45 43.2	. . 05.7	65 05.4	14.7	12 57.3	10.1	54.2
16	60 43.2	06.5	79 39.1	14.5	13 07.4	10.0	54.2
17	75 43.3	07.3	94 12.6	14.6	13 17.4	9.9	54.2
18	90 43.4	N15 08.0	108 46.2	14.4	N13 27.3	9.9	54.2
19	105 43.5	08.8	123 19.6	14.5	13 37.2	9.8	54.2
20	120 43.5	09.5	137 53.1	14.3	13 47.0	9.8	54.2
21	135 43.6	. . 10.3	152 26.4	14.3	13 56.8	9.7	54.3
22	150 43.7	11.0	166 59.7	14.3	14 06.5	9.7	54.3
23	165 43.8	11.8	181 33.0	14.2	14 16.2	9.6	54.3
2 00	180 43.8	N15 12.5	196 06.2	14.2	N14 25.8	9.6	54.3
01	195 43.9	13.3	210 39.4	14.1	14 35.4	9.5	54.3
02	210 44.0	14.0	225 12.5	14.0	14 44.9	9.4	54.3
03	225 44.0	. . 14.8	239 45.5	14.0	14 54.3	9.4	54.3
04	240 44.1	15.5	254 18.5	14.0	15 03.7	9.3	54.3
05	255 44.2	16.3	268 51.5	13.9	15 13.0	9.3	54.3
06	270 44.3	N15 17.0	283 24.4	13.8	N15 22.3	9.2	54.3
07	285 44.3	17.8	297 57.2	13.8	15 31.5	9.1	54.4
08	300 44.4	18.5	312 30.0	13.7	15 40.6	9.1	54.4
M 09	315 44.5	. . 19.3	327 02.7	13.6	15 49.7	9.0	54.4
O 10	330 44.5	20.0	341 35.3	13.6	15 58.7	8.9	54.4
N 11	345 44.6	20.8	356 07.9	13.6	16 07.6	8.9	54.4
D 12	0 44.7	N15 21.5	10 40.5	13.4	N16 16.5	8.8	54.4
A 13	15 44.7	22.3	25 12.9	13.5	16 25.3	8.8	54.4
Y 14	30 44.8	23.0	39 45.4	13.3	16 34.1	8.7	54.4
15	45 44.9	. . 23.8	54 17.7	13.3	16 42.8	8.6	54.4
16	60 45.0	24.5	68 50.0	13.3	16 51.4	8.5	54.5
17	75 45.0	25.3	83 22.3	13.2	16 59.9	8.5	54.5
18	90 45.1	N15 26.0	97 54.5	13.1	N17 08.4	8.4	54.5
19	105 45.2	26.7	112 26.6	13.0	17 16.8	8.3	54.5
20	120 45.2	27.5	126 58.6	13.0	17 25.1	8.3	54.5
21	135 45.3	. . 28.2	141 30.6	13.0	17 33.4	8.1	54.5
22	150 45.4	29.0	156 02.6	12.9	17 41.5	8.1	54.5
23	165 45.4	29.7	170 34.5	12.8	17 49.6	8.1	54.5
3 00	180 45.5	N15 30.5	185 06.3	12.8	N17 57.7	7.9	54.6
01	195 45.6	31.2	199 38.1	12.6	18 05.6	7.9	54.6
02	210 45.6	31.9	214 09.7	12.7	18 13.5	7.8	54.6
03	225 45.7	. . 32.7	228 41.4	12.6	18 21.3	7.7	54.6
04	240 45.8	33.4	243 13.0	12.5	18 29.0	7.6	54.6
05	255 45.8	34.2	257 44.5	12.4	18 36.6	7.6	54.6
06	270 45.9	N15 34.9	272 15.9	12.4	N18 44.2	7.4	54.6
07	285 46.0	35.6	286 47.3	12.3	18 51.6	7.4	54.7
T 08	300 46.0	36.4	301 18.6	12.3	18 59.0	7.3	54.7
U 09	315 46.1	. . 37.1	315 49.9	12.2	19 06.3	7.3	54.7
E 10	330 46.1	37.8	330 21.1	12.2	19 13.6	7.1	54.7
S 11	345 46.2	38.6	344 52.3	12.0	19 20.7	7.0	54.7
D 12	0 46.3	N15 39.3	359 23.3	12.1	N19 27.7	7.0	54.7
A 13	15 46.3	40.1	13 54.4	11.9	19 34.7	6.9	54.7
Y 14	30 46.4	40.8	28 25.3	11.9	19 41.6	6.8	54.7
15	45 46.5	. . 41.5	42 56.2	11.9	19 48.4	6.7	54.8
16	60 46.5	42.3	57 27.1	11.7	19 55.1	6.6	54.8
17	75 46.6	43.0	71 57.8	11.7	20 01.7	6.5	54.8
18	90 46.7	N15 43.7	86 28.5	11.7	N20 08.2	6.4	54.8
19	105 46.7	44.5	100 59.2	11.6	20 14.6	6.3	54.8
20	120 46.8	45.2	115 29.8	11.5	20 20.9	6.3	54.8
21	135 46.8	. . 45.9	130 00.3	11.5	20 27.2	6.1	54.9
22	150 46.9	46.7	144 30.8	11.4	20 33.3	6.1	54.9
23	165 47.0	47.4	159 01.2	11.4	N20 39.4	5.9	54.9
	SD 15.9	d 0.7	SD 14.8		14.8		14.9

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 1	Moonrise 2	Moonrise 3	Moonrise 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	01 47	01 56	01 26	00 07	
N 70	////	////	02 27	02 13	01 56	01 28	
68	////	01 00	02 55	02 26	02 18	02 07	01 48
66	////	01 51	03 15	02 37	02 35	02 34	02 35
64	////	02 22	03 31	02 47	02 50	02 55	03 05
62	00 53	02 45	03 45	02 55	03 02	03 12	03 28
60	01 39	03 03	03 56	03 02	03 12	03 26	03 47
N 58	02 07	03 18	04 06	03 08	03 21	03 38	04 02
56	02 29	03 30	04 15	03 13	03 29	03 49	04 15
54	02 46	03 41	04 22	03 18	03 36	03 58	04 27
52	03 00	03 50	04 29	03 23	03 43	04 07	04 37
50	03 12	03 59	04 35	03 27	03 48	04 14	04 46
45	03 36	04 16	04 49	03 36	04 01	04 30	05 05
N 40	03 54	04 30	04 59	03 43	04 11	04 44	05 21
35	04 09	04 42	05 09	03 49	04 20	04 55	05 34
30	04 21	04 51	05 17	03 55	04 28	05 05	05 46
20	04 40	05 07	05 31	04 05	04 42	05 22	06 06
N 10	04 55	05 21	05 42	04 13	04 54	05 37	06 23
0	05 07	05 32	05 54	04 21	05 05	05 51	06 40
S 10	05 18	05 43	06 05	04 30	05 16	06 05	06 56
20	05 27	05 53	06 16	04 38	05 29	06 20	07 14
30	05 36	06 05	06 29	04 49	05 43	06 38	07 34
35	05 41	06 11	06 37	04 54	05 51	06 48	07 46
40	05 45	06 17	06 45	05 01	06 00	07 00	08 00
45	05 50	06 25	06 55	05 09	06 11	07 14	08 16
S 50	05 55	06 33	07 07	05 18	06 25	07 31	08 36
52	05 57	06 37	07 13	05 23	06 31	07 39	08 46
54	05 59	06 41	07 19	05 28	06 38	07 48	08 56
56	06 02	06 46	07 26	05 33	06 46	07 58	09 09
58	06 04	06 51	07 34	05 39	06 54	08 10	09 23
S 60	06 07	06 57	07 42	05 46	07 04	08 23	09 40

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 1	Moonset 2	Moonset 3	Moonset 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	22 14	////	////	20 03	22 56		
N 70	21 31	////	////	19 35	21 36		
68	21 03	23 06	////	19 14	20 58	22 56	
66	20 42	22 08	////	18 57	20 32	22 10	23 48
64	20 25	21 35	////	18 44	20 12	21 40	23 04
62	20 11	21 12	23 12	18 33	19 55	21 18	22 35
60	19 59	20 53	22 20	18 23	19 42	21 00	22 13
N 58	19 49	20 38	21 50	18 15	19 30	20 45	21 55
56	19 41	20 26	21 28	18 08	19 20	20 32	21 40
54	19 33	20 15	21 11	18 01	19 11	20 21	21 27
52	19 26	20 05	20 56	17 55	19 04	20 11	21 16
50	19 20	19 57	20 44	17 50	18 56	20 02	21 06
45	19 06	19 39	20 19	17 39	18 41	19 44	20 45
N 40	18 55	19 25	20 01	17 30	18 29	19 29	20 28
35	18 46	19 13	19 46	17 22	18 18	19 16	20 13
30	18 38	19 03	19 33	17 15	18 09	19 05	20 01
20	18 24	18 47	19 14	17 03	17 54	18 46	19 39
N 10	18 12	18 34	18 59	16 52	17 40	18 30	19 21
0	18 00	18 22	18 47	16 42	17 27	18 14	19 04
S 10	17 49	18 11	18 36	16 32	17 14	17 59	18 47
20	17 38	18 00	18 27	16 22	17 01	17 42	18 28
30	17 24	17 49	18 18	16 10	16 45	17 24	18 07
35	17 17	17 43	18 13	16 03	16 36	17 13	17 55
40	17 08	17 36	18 08	15 56	16 26	17 00	17 41
45	16 58	17 29	18 04	15 47	16 14	16 46	17 24
S 50	16 46	17 20	17 58	15 36	15 59	16 28	17 03
52	16 40	17 16	17 56	15 31	15 53	16 19	16 53
54	16 34	17 12	17 54	15 25	15 45	16 10	16 42
56	16 27	17 07	17 52	15 19	15 37	15 59	16 30
58	16 20	17 02	17 49	15 13	15 27	15 47	16 15
S 60	16 11	16 57	17 46	15 05	15 17	15 33	15 58

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
1	02 48	02 52	11 57	10 32	22 54	28	3
2	02 55	02 59	11 57	11 16	23 39	29	1
3	03 02	03 05	11 57	12 03	24 27	00	0

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
4 00	221 32.3	206 35.0	N 4 34.4	198 36.1	N 8 50.4	199 50.9	N 7 56.1	29 41.9	S 2 08.9
01	236 34.7	221 34.6	35.6	213 36.8	51.1	214 52.8	56.3	44 44.5	08.9
02	251 37.2	236 34.3	36.7	228 37.5	51.9	229 54.7	56.5	59 47.1	08.8
03	266 39.6	251 33.9	. . 37.9	243 38.2	. . 52.6	244 56.6	. . 56.7	74 49.7	. . 08.8
04	281 42.1	266 33.6	39.0	258 38.9	53.3	259 58.6	56.9	89 52.3	08.7
05	296 44.6	281 33.2	40.2	273 39.6	54.0	275 00.5	57.2	104 54.9	08.6
06	311 47.0	296 32.9	N 4 41.3	288 40.2	N 8 54.7	290 02.4	N 7 57.4	119 57.5	S 2 08.6
W 07	326 49.5	311 32.5	42.5	303 40.9	55.4	305 04.3	57.6	135 00.1	08.5
E 08	341 52.0	326 32.2	43.7	318 41.6	56.1	320 06.2	57.8	150 02.7	08.5
D 09	356 54.4	341 31.9	. . 44.8	333 42.3	. . 56.9	335 08.1	. . 58.0	165 05.3	. . 08.4
N 10	11 56.9	356 31.5	46.0	348 43.0	57.6	350 10.1	58.2	180 07.9	08.4
E 11	26 59.4	11 31.2	47.1	3 43.7	58.3	5 12.0	58.4	195 10.5	08.3
S 12	42 01.8	26 30.8	N 4 48.3	18 44.4	N 8 59.0	20 13.9	N 7 58.7	210 13.1	S 2 08.3
D 13	57 04.3	41 30.5	49.4	33 45.0	8 59.7	35 15.8	58.9	225 15.7	08.2
A 14	72 06.8	56 30.1	50.6	48 45.7	9 00.4	50 17.7	59.1	240 18.3	08.2
Y 15	87 09.2	71 29.8	. . 51.7	63 46.4	. . 01.1	65 19.6	. . 59.3	255 20.9	. . 08.1
16	102 11.7	86 29.4	52.9	78 47.1	01.8	80 21.5	59.5	270 23.5	08.1
17	117 14.1	101 29.1	54.1	93 47.8	02.6	95 23.5	59.7	285 26.1	08.0
18	132 16.6	116 28.7	N 4 55.2	108 48.5	N 9 03.3	110 25.4	N 7 59.9	300 28.7	S 2 08.0
19	147 19.1	131 28.4	56.4	123 49.2	04.0	125 27.3	8 00.2	315 31.3	07.9
20	162 21.5	146 28.0	57.5	138 49.8	04.7	140 29.2	00.4	330 34.0	07.9
21	177 24.0	161 27.7	. . 58.7	153 50.5	. . 05.4	155 31.1	. . 00.6	345 36.6	. . 07.8
22	192 26.5	176 27.4	4 59.8	168 51.2	06.1	170 33.0	00.8	0 39.2	07.8
23	207 28.9	191 27.0	5 01.0	183 51.9	06.8	185 35.0	01.0	15 41.8	07.7
5 00	222 31.4	206 26.7	N 5 02.1	198 52.6	N 9 07.5	200 36.9	N 8 01.2	30 44.4	S 2 07.7
01	237 33.9	221 26.3	03.3	213 53.3	08.3	215 38.8	01.4	45 47.0	07.6
02	252 36.3	236 26.0	04.4	228 53.9	09.0	230 40.7	01.7	60 49.6	07.5
03	267 38.8	251 25.6	. . 05.6	243 54.6	. . 09.7	245 42.6	. . 01.9	75 52.2	. . 07.5
04	282 41.2	266 25.3	06.8	258 55.3	10.4	260 44.5	02.1	90 54.8	07.4
05	297 43.7	281 24.9	07.9	273 56.0	11.1	275 46.5	02.3	105 57.4	07.4
06	312 46.2	296 24.6	N 5 09.1	288 56.7	N 9 11.8	290 48.4	N 8 02.5	121 00.0	S 2 07.3
T 07	327 48.6	311 24.2	10.2	303 57.4	12.5	305 50.3	02.7	136 02.6	07.3
H 08	342 51.1	326 23.9	11.4	318 58.0	13.2	320 52.2	02.9	151 05.2	07.2
U 09	357 53.6	341 23.5	. . 12.5	333 58.7	. . 13.9	335 54.1	. . 03.1	166 07.8	. . 07.2
R 10	12 56.0	356 23.2	13.7	348 59.4	14.6	350 56.0	03.4	181 10.4	07.1
S 11	27 58.5	11 22.8	14.8	4 00.1	15.4	5 58.0	03.6	196 13.0	07.1
D 12	43 01.0	26 22.5	N 5 16.0	19 00.8	N 9 16.1	20 59.9	N 8 03.8	211 15.6	S 2 07.0
A 13	58 03.4	41 22.1	17.1	34 01.5	16.8	36 01.8	04.0	226 18.2	07.0
Y 14	73 05.9	56 21.8	18.3	49 02.1	17.5	51 03.7	04.2	241 20.8	06.9
15	88 08.4	71 21.4	. . 19.4	64 02.8	. . 18.2	66 05.6	. . 04.4	256 23.4	. . 06.9
16	103 10.8	86 21.1	20.6	79 03.5	18.9	81 07.5	04.6	271 26.0	06.8
17	118 13.3	101 20.7	21.7	94 04.2	19.6	96 09.5	04.9	286 28.6	06.8
18	133 15.7	116 20.4	N 5 22.9	109 04.9	N 9 20.3	111 11.4	N 8 05.1	301 31.2	S 2 06.7
19	148 18.2	131 20.0	24.0	124 05.6	21.0	126 13.3	05.3	316 33.8	06.7
20	163 20.7	146 19.7	25.2	139 06.2	21.7	141 15.2	05.5	331 36.4	06.6
21	178 23.1	161 19.3	. . 26.3	154 06.9	. . 22.4	156 17.1	. . 05.7	346 39.0	. . 06.6
22	193 25.6	176 19.0	27.5	169 07.6	23.1	171 19.0	05.9	1 41.6	06.5
23	208 28.1	191 18.6	28.6	184 08.3	23.9	186 21.0	06.1	16 44.2	06.5
6 00	223 30.5	206 18.3	N 5 29.8	199 09.0	N 9 24.6	201 22.9	N 8 06.3	31 46.8	S 2 06.4
01	238 33.0	221 17.9	30.9	214 09.7	25.3	216 24.8	06.6	46 49.4	06.4
02	253 35.5	236 17.6	32.1	229 10.3	26.0	231 26.7	06.8	61 52.0	06.3
03	268 37.9	251 17.2	. . 33.2	244 11.0	. . 26.7	246 28.6	. . 07.0	76 54.6	. . 06.3
04	283 40.4	266 16.8	34.4	259 11.7	27.4	261 30.5	07.2	91 57.2	06.2
05	298 42.9	281 16.5	35.5	274 12.4	28.1	276 32.5	07.4	106 59.8	06.2
06	313 45.3	296 16.1	N 5 36.7	289 13.1	N 9 28.8	291 34.4	N 8 07.6	122 02.4	S 2 06.1
07	328 47.8	311 15.8	37.8	304 13.8	29.5	306 36.3	07.8	137 05.0	06.1
08	343 50.2	326 15.4	39.0	319 14.4	30.2	321 38.2	08.0	152 07.6	06.0
F 09	358 52.7	341 15.1	. . 40.1	334 15.1	. . 30.9	336 40.1	. . 08.3	167 10.2	. . 06.0
R 10	13 55.2	356 14.7	41.3	349 15.8	31.6	351 42.0	08.5	182 12.8	05.9
I 11	28 57.6	11 14.4	42.4	4 16.5	32.3	6 44.0	08.7	197 15.4	05.9
D 12	44 00.1	26 14.0	N 5 43.6	19 17.2	N 9 33.0	21 45.9	N 8 08.9	212 18.0	S 2 05.8
A 13	59 02.6	41 13.7	44.7	34 17.9	33.7	36 47.8	09.1	227 20.6	05.8
Y 14	74 05.0	56 13.3	45.9	49 18.5	34.4	51 49.7	09.3	242 23.2	05.7
15	89 07.5	71 13.0	. . 47.0	64 19.2	. . 35.1	66 51.6	. . 09.5	257 25.8	. . 05.7
16	104 10.0	86 12.6	48.2	79 19.9	35.8	81 53.6	09.7	272 28.4	05.6
17	119 12.4	101 12.2	49.3	94 20.6	36.6	96 55.5	10.0	287 31.0	05.6
18	134 14.9	116 11.9	N 5 50.5	109 21.3	N 9 37.3	111 57.4	N 8 10.2	302 33.6	S 2 05.5
19	149 17.4	131 11.5	51.6	124 22.0	38.0	126 59.3	10.4	317 36.2	05.5
20	164 19.8	146 11.2	52.8	139 22.6	38.7	142 01.2	10.6	332 38.8	05.4
21	179 22.3	161 10.8	. . 53.9	154 23.3	. . 39.4	157 03.1	. . 10.8	347 41.4	. . 05.4
22	194 24.7	176 10.5	55.1	169 24.0	40.1	172 05.1	11.0	2 43.9	05.3
23	209 27.2	191 10.1	56.2	184 24.7	40.8	187 07.0	11.2	17 46.5	05.3
	h m								
Mer. Pass.	9 08.4	v −0.3	d 1.2	v 0.7	d 0.7	v 1.9	d 0.2	v 2.6	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.6
Achernar	335 28.4	S57 10.6
Acrux	173 10.6	S63 10.1
Adhara	255 13.9	S28 59.5
Aldebaran	290 51.5	N16 31.8
Alioth	166 21.4	N55 53.9
Alkaid	152 59.6	N49 15.3
Al Na'ir	27 45.7	S46 54.1
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.5
Alpheratz	357 45.4	N29 09.1
Altair	62 09.6	N 8 53.9
Ankaa	353 17.5	S42 14.5
Antares	112 27.8	S26 27.4
Arcturus	145 56.8	N19 07.3
Atria	107 30.6	S69 02.7
Avior	234 18.8	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.2	S52 42.4
Capella	280 37.1	N46 00.6
Deneb	49 32.5	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.7	S17 55.4
Dubhe	193 53.1	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.5	N51 29.1
Enif	33 48.7	N 9 55.6
Fomalhaut	15 25.8	S29 33.6
Gacrux	172 02.2	S57 10.9
Gienah	175 53.6	S17 36.6
Hadar	148 49.5	S60 25.8
Hamal	328 02.8	N23 30.9
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 18.6	N74 06.5
Markab	13 40.0	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.0	S36 25.7
Miaplacidus	221 40.1	S69 46.3
Mirfak	308 43.1	N49 54.1
Nunki	76 00.0	S26 16.8
Peacock	53 21.5	S56 41.6
Pollux	243 29.7	N27 59.9
Procyon	245 01.4	N 5 11.6
Rasalhague	96 07.6	N12 33.0
Regulus	207 45.0	N11 54.6
Rigel	281 13.8	S 8 11.5
Rigil Kent.	139 53.2	S60 53.0
Sabik	102 14.0	S15 44.3
Schedar	349 42.8	N56 35.8
Shaula	96 23.7	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.6	S43 29.1
Vega	80 39.7	N38 47.5
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	343 55.3	10 14
Mars	336 21.2	10 44
Jupiter	338 05.5	10 36
Saturn	168 13.0	21 53

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
4 00	180 47.0	N15 48.1	173 31.6	11.3	N20 45.3	5.9	54.9
01	195 47.1	48.8	188 01.9	11.2	20 51.2	5.7	54.9
02	210 47.1	49.6	202 32.1	11.2	20 56.9	5.7	54.9
03	225 47.2	. . 50.3	217 02.3	11.1	21 02.6	5.6	54.9
04	240 47.3	51.0	231 32.4	11.0	21 08.2	5.4	55.0
05	255 47.3	51.8	246 02.4	11.0	21 13.6	5.4	55.0
06	270 47.4	N15 52.5	260 32.4	11.0	N21 19.0	5.3	55.0
W 07	285 47.4	53.2	275 02.4	10.9	21 24.3	5.1	55.0
E 08	300 47.5	53.9	289 32.3	10.8	21 29.4	5.1	55.0
D 09	315 47.6	. . 54.7	304 02.1	10.8	21 34.5	4.9	55.0
N 10	330 47.6	55.4	318 31.9	10.7	21 39.4	4.9	55.1
E 11	345 47.7	56.1	333 01.6	10.6	21 44.3	4.7	55.1
S 12	0 47.7	N15 56.9	347 31.2	10.7	N21 49.0	4.6	55.1
D 13	15 47.8	57.6	2 00.9	10.5	21 53.6	4.6	55.1
A 14	30 47.8	58.3	16 30.4	10.5	21 58.2	4.4	55.1
Y 15	45 47.9	. . 59.0	30 59.9	10.5	22 02.6	4.3	55.1
16	60 48.0	15 59.7	45 29.4	10.3	22 06.9	4.2	55.2
17	75 48.0	16 00.5	59 58.7	10.4	22 11.1	4.1	55.2
18	90 48.1	N16 01.2	74 28.1	10.3	N22 15.2	4.0	55.2
19	105 48.1	01.9	88 57.4	10.2	22 19.2	3.9	55.2
20	120 48.2	02.6	103 26.6	10.2	22 23.1	3.7	55.2
21	135 48.2	. . 03.4	117 55.8	10.1	22 26.8	3.7	55.3
22	150 48.3	04.1	132 24.9	10.1	22 30.5	3.5	55.3
23	165 48.4	04.8	146 54.0	10.1	22 34.0	3.5	55.3
5 00	180 48.4	N16 05.5	161 23.1	10.0	N22 37.5	3.3	55.3
01	195 48.5	06.2	175 52.1	9.9	22 40.8	3.2	55.3
02	210 48.5	07.0	190 21.0	9.9	22 44.0	3.1	55.3
03	225 48.6	. . 07.7	204 49.9	9.9	22 47.1	2.9	55.4
04	240 48.6	08.4	219 18.8	9.8	22 50.0	2.9	55.4
05	255 48.7	09.1	233 47.6	9.8	22 52.9	2.7	55.4
06	270 48.7	N16 09.8	248 16.4	9.7	N22 55.6	2.6	55.4
07	285 48.8	10.5	262 45.1	9.7	22 58.2	2.5	55.4
T 08	300 48.8	11.3	277 13.8	9.6	23 00.7	2.4	55.5
H 09	315 48.9	. . 12.0	291 42.4	9.6	23 03.1	2.3	55.5
U 10	330 48.9	12.7	306 11.0	9.6	23 05.4	2.1	55.5
R 11	345 49.0	13.4	320 39.6	9.5	23 07.5	2.1	55.5
S 12	0 49.1	N16 14.1	335 08.1	9.5	N23 09.6	1.9	55.5
D 13	15 49.1	14.8	349 36.6	9.5	23 11.5	1.7	55.5
A 14	30 49.2	15.5	4 05.1	9.4	23 13.2	1.7	55.6
Y 15	45 49.2	. . 16.3	18 33.5	9.4	23 14.9	1.5	55.6
16	60 49.3	17.0	33 01.9	9.3	23 16.4	1.5	55.6
17	75 49.3	17.7	47 30.2	9.3	23 17.9	1.3	55.6
18	90 49.4	N16 18.4	61 58.5	9.3	N23 19.2	1.1	55.6
19	105 49.4	19.1	76 26.8	9.2	23 20.3	1.1	55.7
20	120 49.5	19.8	90 55.0	9.3	23 21.4	0.9	55.7
21	135 49.5	. . 20.5	105 23.3	9.2	23 22.3	0.8	55.7
22	150 49.6	21.2	119 51.5	9.1	23 23.1	0.7	55.7
23	165 49.6	21.9	134 19.6	9.2	23 23.8	0.5	55.7
6 00	180 49.7	N16 22.7	148 47.8	9.1	N23 24.3	0.5	55.8
01	195 49.7	23.4	163 15.9	9.0	23 24.8	0.3	55.8
02	210 49.8	24.1	177 43.9	9.1	23 25.1	0.1	55.8
03	225 49.8	. . 24.8	192 12.0	9.0	23 25.2	0.1	55.8
04	240 49.9	25.5	206 40.0	9.0	23 25.3	0.1	55.8
05	255 49.9	26.2	221 08.0	9.0	23 25.2	0.2	55.9
06	270 50.0	N16 26.9	235 36.0	9.0	N23 25.0	0.3	55.9
07	285 50.0	27.6	250 04.0	8.9	23 24.7	0.5	55.9
08	300 50.0	28.3	264 31.9	9.0	23 24.2	0.5	55.9
F 09	315 50.1	. . 29.0	278 59.9	8.9	23 23.7	0.8	55.9
R 10	330 50.1	29.7	293 27.8	8.9	23 22.9	0.8	56.0
I 11	345 50.2	30.4	307 55.7	8.9	23 22.1	1.0	56.0
D 12	0 50.2	N16 31.1	322 23.6	8.8	N23 21.1	1.0	56.0
A 13	15 50.3	31.8	336 51.4	8.9	23 20.1	1.3	56.0
Y 14	30 50.3	32.5	351 19.3	8.8	23 18.8	1.3	56.1
15	45 50.4	. . 33.2	5 47.1	8.8	23 17.5	1.5	56.1
16	60 50.4	33.9	20 14.9	8.9	23 16.0	1.6	56.1
17	75 50.5	34.6	34 42.8	8.8	23 14.4	1.7	56.1
18	90 50.5	N16 35.3	49 10.6	8.8	N23 12.7	1.9	56.1
19	105 50.6	36.0	63 38.4	8.8	23 10.8	2.0	56.2
20	120 50.6	36.7	78 06.2	8.8	23 08.8	2.1	56.2
21	135 50.6	. . 37.4	92 34.0	8.7	23 06.7	2.2	56.2
22	150 50.7	38.1	107 01.7	8.8	23 04.5	2.4	56.2
23	165 50.7	38.8	121 29.5	8.8	N23 02.1	2.5	56.2
	SD 15.9	d 0.7	SD	15.0	15.1		15.3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 4	Moonrise 5	Moonrise 6	Moonrise 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	01 18				
N 70	////	////	02 09				
68	////	////	02 40	01 48			
66	////	01 31	03 03	02 35	02 41	03 10	04 27
64	////	02 08	03 21	03 05	03 25	04 05	05 13
62	////	02 33	03 36	03 28	03 55	04 38	05 42
60	01 21	02 53	03 48	03 47	04 17	05 03	06 05
N 58	01 55	03 09	03 59	04 02	04 35	05 22	06 23
56	02 18	03 22	04 08	04 15	04 51	05 38	06 39
54	02 37	03 34	04 16	04 27	05 04	05 52	06 52
52	02 52	03 44	04 24	04 37	05 15	06 04	07 03
50	03 05	03 53	04 30	04 46	05 26	06 15	07 13
45	03 31	04 11	04 44	05 05	05 47	06 37	07 35
N 40	03 50	04 26	04 56	05 21	06 05	06 55	07 52
35	04 05	04 38	05 06	05 34	06 19	07 10	08 07
30	04 18	04 49	05 14	05 46	06 32	07 23	08 19
20	04 38	05 06	05 29	06 06	06 54	07 46	08 41
N 10	04 54	05 20	05 42	06 23	07 13	08 05	08 59
0	05 07	05 32	05 53	06 40	07 31	08 23	09 17
S 10	05 18	05 43	06 05	06 56	07 48	08 41	09 34
20	05 28	05 54	06 17	07 14	08 07	09 01	09 53
30	05 38	06 06	06 31	07 34	08 29	09 23	10 14
35	05 43	06 13	06 39	07 46	08 42	09 36	10 26
40	05 48	06 20	06 48	08 00	08 57	09 52	10 41
45	05 53	06 28	06 59	08 16	09 15	10 10	10 58
S 50	05 59	06 37	07 12	08 36	09 37	10 32	11 19
52	06 01	06 42	07 18	08 46	09 48	10 43	11 29
54	06 04	06 46	07 25	08 56	10 00	10 55	11 40
56	06 07	06 51	07 32	09 09	10 14	11 09	11 53
58	06 09	06 57	07 40	09 23	10 30	11 25	12 08
S 60	06 13	07 03	07 50	09 40	10 49	11 45	12 25

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 4	Moonset 5	Moonset 6	Moonset 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	22 46	////	////				
N 70	21 50	////	////				
68	21 17	////	////				
66	20 53	22 29	////	23 48	25 09	01 09	01 43
64	20 35	21 50	////	23 04	24 13	00 13	00 57
62	20 19	21 23	////	22 35	23 40	24 27	00 27
60	20 07	21 03	22 38	22 13	23 16	24 04	00 04
N 58	19 56	20 46	22 03	21 55	22 57	23 46	24 22
56	19 47	20 33	21 38	21 40	22 40	23 30	24 08
54	19 38	20 21	21 19	21 27	22 27	23 17	23 57
52	19 31	20 11	21 03	21 16	22 15	23 05	23 46
50	19 24	20 02	20 50	21 06	22 04	22 55	23 37
45	19 10	19 43	20 24	20 45	21 42	22 33	23 18
N 40	18 58	19 28	20 04	20 28	21 24	22 15	23 02
35	18 48	19 16	19 49	20 13	21 09	22 01	22 48
30	18 40	19 05	19 36	20 01	20 56	21 48	22 37
20	18 25	18 48	19 16	19 39	20 33	21 26	22 16
N 10	18 12	18 34	19 00	19 21	20 14	21 07	21 59
0	18 00	18 22	18 47	19 04	19 56	20 49	21 42
S 10	17 48	18 10	18 35	18 47	19 38	20 31	21 26
20	17 36	17 59	18 25	18 28	19 18	20 12	21 08
30	17 22	17 47	18 15	18 07	18 56	19 49	20 47
35	17 14	17 40	18 10	17 55	18 43	19 36	20 35
40	17 05	17 33	18 05	17 41	18 28	19 21	20 21
45	16 54	17 25	18 00	17 24	18 10	19 03	20 05
S 50	16 41	17 15	17 54	17 03	17 47	18 41	19 44
52	16 35	17 11	17 52	16 53	17 36	18 30	19 34
54	16 28	17 07	17 49	16 42	17 24	18 18	19 23
56	16 21	17 01	17 46	16 30	17 11	18 04	19 11
58	16 13	16 56	17 43	16 15	16 54	17 48	18 56
S 60	16 03	16 50	17 40	15 58	16 35	17 29	18 39

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
4	03 08	03 11	11 57	12 52	00 27	01	1
5	03 14	03 16	11 57	13 43	01 17	02	5
6	03 19	03 21	11 57	14 36	02 09	03	10

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
7 00	224 29.7	206 09.8	N 5 57.3	199 25.4	N 9 41.5	202 08.9	N 8 11.4	32 49.1	S 2 05.2
01	239 32.1	221 09.4	58.5	214 26.0	42.2	217 10.8	11.6	47 51.7	05.2
02	254 34.6	236 09.0	5 59.6	229 26.7	42.9	232 12.7	11.9	62 54.3	05.1
03	269 37.1	251 08.7	6 00.8	244 27.4	43.6	247 14.7	12.1	77 56.9	05.1
04	284 39.5	266 08.3	01.9	259 28.1	44.3	262 16.6	12.3	92 59.5	05.0
05	299 42.0	281 08.0	03.1	274 28.8	45.0	277 18.5	12.5	108 02.1	05.0
06	314 44.5	296 07.6	N 6 04.2	289 29.5	N 9 45.7	292 20.4	N 8 12.7	123 04.7	S 2 04.9
07	329 46.9	311 07.3	05.4	304 30.1	46.4	307 22.3	12.9	138 07.3	04.9
S 08	344 49.4	326 06.9	06.5	319 30.8	47.1	322 24.2	13.1	153 09.9	04.8
A 09	359 51.9	341 06.5	07.7	334 31.5	47.8	337 26.2	13.3	168 12.5	04.8
T 10	14 54.3	356 06.2	08.8	349 32.2	48.5	352 28.1	13.5	183 15.1	04.7
U 11	29 56.8	11 05.8	09.9	4 32.9	49.2	7 30.0	13.8	198 17.7	04.7
R 12	44 59.2	26 05.5	N 6 11.1	19 33.6	N 9 49.9	22 31.9	N 8 14.0	213 20.3	S 2 04.6
D 13	60 01.7	41 05.1	12.2	34 34.2	50.6	37 33.8	14.2	228 22.9	04.6
A 14	75 04.2	56 04.8	13.4	49 34.9	51.3	52 35.8	14.4	243 25.5	04.5
Y 15	90 06.6	71 04.4	14.5	64 35.6	52.0	67 37.7	14.6	258 28.1	04.5
16	105 09.1	86 04.0	15.7	79 36.3	52.7	82 39.6	14.8	273 30.7	04.4
17	120 11.6	101 03.7	16.8	94 37.0	53.4	97 41.5	15.0	288 33.3	04.4
18	135 14.0	116 03.3	N 6 17.9	109 37.6	N 9 54.1	112 43.4	N 8 15.2	303 35.9	S 2 04.4
19	150 16.5	131 03.0	19.1	124 38.3	54.8	127 45.4	15.4	318 38.5	04.3
20	165 19.0	146 02.6	20.2	139 39.0	55.5	142 47.3	15.7	333 41.1	04.3
21	180 21.4	161 02.2	21.4	154 39.7	56.2	157 49.2	15.9	348 43.7	04.2
22	195 23.9	176 01.9	22.5	169 40.4	56.9	172 51.1	16.1	3 46.2	04.2
23	210 26.3	191 01.5	23.7	184 41.0	57.6	187 53.0	16.3	18 48.8	04.1
8 00	225 28.8	206 01.2	N 6 24.8	199 41.7	N 9 58.3	202 55.0	N 8 16.5	33 51.4	S 2 04.1
01	240 31.3	221 00.8	25.9	214 42.4	59.0	217 56.9	16.7	48 54.0	04.0
02	255 33.7	236 00.4	27.1	229 43.1	9 59.7	232 58.8	16.9	63 56.6	04.0
03	270 36.2	251 00.1	28.2	244 43.8	10 00.4	248 00.7	17.1	78 59.2	03.9
04	285 38.7	265 59.7	29.4	259 44.5	01.1	263 02.6	17.3	94 01.8	03.9
05	300 41.1	280 59.3	30.5	274 45.1	01.8	278 04.6	17.6	109 04.4	03.8
06	315 43.6	295 59.0	N 6 31.6	289 45.8	N10 02.5	293 06.5	N 8 17.8	124 07.0	S 2 03.8
07	330 46.1	310 58.6	32.8	304 46.5	03.2	308 08.4	18.0	139 09.6	03.7
08	345 48.5	325 58.3	33.9	319 47.2	03.9	323 10.3	18.2	154 12.2	03.7
S 09	0 51.0	340 57.9	35.1	334 47.9	04.5	338 12.2	18.4	169 14.8	03.6
U 10	15 53.5	355 57.5	36.2	349 48.5	05.2	353 14.2	18.6	184 17.4	03.6
N 11	30 55.9	10 57.2	37.3	4 49.2	05.9	8 16.1	18.8	199 20.0	03.5
D 12	45 58.4	25 56.8	N 6 38.5	19 49.9	N10 06.6	23 18.0	N 8 19.0	214 22.6	S 2 03.5
A 13	61 00.8	40 56.4	39.6	34 50.6	07.3	38 19.9	19.2	229 25.2	03.4
Y 14	76 03.3	55 56.1	40.8	49 51.3	08.0	53 21.8	19.4	244 27.7	03.4
15	91 05.8	70 55.7	41.9	64 51.9	08.7	68 23.8	19.7	259 30.3	03.4
16	106 08.2	85 55.3	43.0	79 52.6	09.4	83 25.7	19.9	274 32.9	03.3
17	121 10.7	100 55.0	44.2	94 53.3	10.1	98 27.6	20.1	289 35.5	03.3
18	136 13.2	115 54.6	N 6 45.3	109 54.0	N10 10.8	113 29.5	N 8 20.3	304 38.1	S 2 03.2
19	151 15.6	130 54.3	46.4	124 54.7	11.5	128 31.4	20.5	319 40.7	03.2
20	166 18.1	145 53.9	47.6	139 55.3	12.2	143 33.4	20.7	334 43.3	03.1
21	181 20.6	160 53.5	48.7	154 56.0	12.9	158 35.3	20.9	349 45.9	03.1
22	196 23.0	175 53.2	49.8	169 56.7	13.6	173 37.2	21.1	4 48.5	03.0
23	211 25.5	190 52.8	51.0	184 57.4	14.3	188 39.1	21.3	19 51.1	03.0
9 00	226 28.0	205 52.4	N 6 52.1	199 58.1	N10 15.0	203 41.0	N 8 21.5	34 53.7	S 2 02.9
01	241 30.4	220 52.1	53.3	214 58.7	15.7	218 43.0	21.8	49 56.3	02.9
02	256 32.9	235 51.7	54.4	229 59.4	16.4	233 44.9	22.0	64 58.8	02.8
03	271 35.3	250 51.3	55.5	245 00.1	17.0	248 46.8	22.2	80 01.4	02.8
04	286 37.8	265 51.0	56.7	260 00.8	17.7	263 48.7	22.4	95 04.0	02.7
05	301 40.3	280 50.6	57.8	275 01.5	18.4	278 50.6	22.6	110 06.6	02.7
06	316 42.7	295 50.2	N 6 58.9	290 02.1	N10 19.1	293 52.6	N 8 22.8	125 09.2	S 2 02.7
07	331 45.2	310 49.9	7 00.1	305 02.8	19.8	308 54.5	23.0	140 11.8	02.6
08	346 47.7	325 49.5	01.2	320 03.5	20.5	323 56.4	23.2	155 14.4	02.6
M 09	1 50.1	340 49.1	02.3	335 04.2	21.2	338 58.3	23.4	170 17.0	02.5
O 10	16 52.6	355 48.8	03.5	350 04.9	21.9	354 00.3	23.6	185 19.6	02.5
N 11	31 55.1	10 48.4	04.6	5 05.5	22.6	9 02.2	23.8	200 22.2	02.4
D 12	46 57.5	25 48.0	N 7 05.7	20 06.2	N10 23.3	24 04.1	N 8 24.1	215 24.8	S 2 02.4
A 13	62 00.0	40 47.7	06.9	35 06.9	24.0	39 06.0	24.3	230 27.3	02.3
Y 14	77 02.5	55 47.3	08.0	50 07.6	24.7	54 07.9	24.5	245 29.9	02.3
15	92 04.9	70 46.9	09.1	65 08.3	25.3	69 09.9	24.7	260 32.5	02.2
16	107 07.4	85 46.5	10.3	80 08.9	26.0	84 11.8	24.9	275 35.1	02.2
17	122 09.8	100 46.2	11.4	95 09.6	26.7	99 13.7	25.1	290 37.7	02.1
18	137 12.3	115 45.8	N 7 12.5	110 10.3	N10 27.4	114 15.6	N 8 25.3	305 40.3	S 2 02.1
19	152 14.8	130 45.4	13.7	125 11.0	28.1	129 17.6	25.5	320 42.9	02.1
20	167 17.2	145 45.1	14.8	140 11.6	28.8	144 19.5	25.7	335 45.5	02.0
21	182 19.7	160 44.7	15.9	155 12.3	29.5	159 21.4	25.9	350 48.1	02.0
22	197 22.2	175 44.3	17.1	170 13.0	30.2	174 23.3	26.1	5 50.6	01.9
23	212 24.6	190 44.0	18.2	185 13.7	30.9	189 25.2	26.4	20 53.2	01.9
	h m								
Mer. Pass.	8 56.6	*v* −0.4	*d* 1.1	*v* 0.7	*d* 0.7	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.6
Achernar	335 28.4	S57 10.6
Acrux	173 10.6	S63 10.1
Adhara	255 13.9	S28 59.5
Aldebaran	290 51.4	N16 31.8
Alioth	166 21.5	N55 53.9
Alkaid	152 59.6	N49 15.4
Al Na'ir	27 45.7	S46 54.1
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.5
Alpheratz	357 45.4	N29 09.1
Altair	62 09.6	N 8 53.9
Ankaa	353 17.5	S42 14.5
Antares	112 27.8	S26 27.4
Arcturus	145 56.8	N19 07.3
Atria	107 30.5	S69 02.8
Avior	234 18.9	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.2	S52 42.4
Capella	280 37.1	N46 00.6
Deneb	49 32.5	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.7	S17 55.4
Dubhe	193 53.1	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.4	N51 29.1
Enif	33 48.7	N 9 55.6
Fomalhaut	15 25.8	S29 33.5
Gacrux	172 02.2	S57 10.9
Gienah	175 53.6	S17 36.6
Hadar	148 49.5	S60 25.9
Hamal	328 02.8	N23 30.9
Kaus Aust.	83 45.5	S34 22.6
Kochab	137 18.6	N74 06.5
Markab	13 40.0	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.0	S36 25.7
Miaplacidus	221 40.1	S69 46.3
Mirfak	308 43.1	N49 54.0
Nunki	76 00.0	S26 16.8
Peacock	53 21.4	S56 41.6
Pollux	243 29.7	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.6	N12 33.0
Regulus	207 45.0	N11 54.6
Rigel	281 13.8	S 8 11.5
Rigil Kent.	139 53.2	S60 53.0
Sabik	102 14.0	S15 44.3
Schedar	349 42.8	N56 35.8
Shaula	96 23.6	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.6	S43 29.1
Vega	80 39.7	N38 47.5
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	340 32.3	10 16
Mars	334 12.9	10 41
Jupiter	337 26.1	10 27
Saturn	168 22.6	21 41

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
7 00	180 50.8	N16 39.5	135 57.3	8.8	N22 59.6	2.6	56.3
01	195 50.8	40.2	150 25.1	8.7	22 57.0	2.8	56.3
02	210 50.9	40.9	164 52.8	8.8	22 54.2	2.9	56.3
03	225 50.9	. . 41.6	179 20.6	8.8	22 51.3	3.0	56.3
04	240 50.9	42.3	193 48.4	8.7	22 48.3	3.1	56.4
05	255 51.0	43.0	208 16.1	8.8	22 45.2	3.3	56.4
06	270 51.0	N16 43.7	222 43.9	8.8	N22 41.9	3.4	56.4
07	285 51.1	44.4	237 11.7	8.7	22 38.5	3.5	56.4
S 08	300 51.1	45.1	251 39.4	8.8	22 35.0	3.6	56.4
A 09	315 51.2	. . 45.8	266 07.2	8.8	22 31.4	3.8	56.5
T 10	330 51.2	46.5	280 35.0	8.8	22 27.6	3.9	56.5
U 11	345 51.2	47.2	295 02.8	8.8	22 23.7	4.0	56.5
R 12	0 51.3	N16 47.8	309 30.6	8.8	N22 19.7	4.2	56.5
D 13	15 51.3	48.5	323 58.4	8.8	22 15.5	4.3	56.6
A 14	30 51.4	49.2	338 26.2	8.9	22 11.2	4.4	56.6
Y 15	45 51.4	. . 49.9	352 54.1	8.8	22 06.8	4.5	56.6
16	60 51.4	50.6	7 21.9	8.9	22 02.3	4.6	56.6
17	75 51.5	51.3	21 49.8	8.8	21 57.7	4.8	56.7
18	90 51.5	N16 52.0	36 17.6	8.9	N21 52.9	4.9	56.7
19	105 51.6	52.7	50 45.5	8.9	21 48.0	5.0	56.7
20	120 51.6	53.4	65 13.4	8.9	21 43.0	5.2	56.7
21	135 51.6	. . 54.0	79 41.3	8.9	21 37.8	5.3	56.8
22	150 51.7	54.7	94 09.2	9.0	21 32.5	5.4	56.8
23	165 51.7	55.4	108 37.2	8.9	21 27.1	5.5	56.8
8 00	180 51.8	N16 56.1	123 05.1	9.0	N21 21.6	5.6	56.8
01	195 51.8	56.8	137 33.1	9.0	21 16.0	5.8	56.8
02	210 51.8	57.5	152 01.1	9.0	21 10.2	5.9	56.9
03	225 51.9	. . 58.2	166 29.1	9.0	21 04.3	6.0	56.9
04	240 51.9	58.8	180 57.1	9.0	20 58.3	6.1	56.9
05	255 51.9	16 59.5	195 25.1	9.1	20 52.2	6.2	56.9
06	270 52.0	N17 00.2	209 53.2	9.1	N20 46.0	6.4	57.0
07	285 52.0	00.9	224 21.3	9.1	20 39.6	6.5	57.0
08	300 52.0	01.6	238 49.4	9.1	20 33.1	6.6	57.0
S 09	315 52.1	. . 02.2	253 17.5	9.2	20 26.5	6.7	57.0
U 10	330 52.1	02.9	267 45.7	9.1	20 19.8	6.8	57.1
N 11	345 52.2	03.6	282 13.8	9.2	20 13.0	7.0	57.1
D 12	0 52.2	N17 04.3	296 42.0	9.2	N20 06.0	7.0	57.1
A 13	15 52.2	05.0	311 10.2	9.3	19 59.0	7.2	57.1
Y 14	30 52.3	05.6	325 38.5	9.2	19 51.8	7.3	57.2
15	45 52.3	. . 06.3	340 06.7	9.3	19 44.5	7.4	57.2
16	60 52.3	07.0	354 35.0	9.3	19 37.1	7.6	57.2
17	75 52.4	07.7	9 03.3	9.4	19 29.5	7.6	57.2
18	90 52.4	N17 08.4	23 31.7	9.4	N19 21.9	7.7	57.3
19	105 52.4	09.0	38 00.1	9.3	19 14.2	7.9	57.3
20	120 52.5	09.7	52 28.4	9.5	19 06.3	8.0	57.3
21	135 52.5	. . 10.4	66 56.9	9.4	18 58.3	8.1	57.3
22	150 52.5	11.1	81 25.3	9.5	18 50.2	8.1	57.4
23	165 52.6	11.7	95 53.8	9.5	18 42.1	8.3	57.4
9 00	180 52.6	N17 12.4	110 22.3	9.5	N18 33.8	8.5	57.4
01	195 52.6	13.1	124 50.8	9.5	18 25.3	8.5	57.5
02	210 52.7	13.7	139 19.3	9.6	18 16.8	8.6	57.5
03	225 52.7	. . 14.4	153 47.9	9.6	18 08.2	8.7	57.5
04	240 52.7	15.1	168 16.5	9.7	17 59.5	8.9	57.5
05	255 52.7	15.8	182 45.2	9.6	17 50.6	8.9	57.6
06	270 52.8	N17 16.4	197 13.8	9.7	N17 41.7	9.1	57.6
07	285 52.8	17.1	211 42.5	9.7	17 32.6	9.1	57.6
08	300 52.8	17.8	226 11.2	9.8	17 23.5	9.3	57.6
M 09	315 52.9	. . 18.4	240 40.0	9.7	17 14.2	9.3	57.7
O 10	330 52.9	19.1	255 08.7	9.8	17 04.9	9.5	57.7
N 11	345 52.9	19.8	269 37.5	9.9	16 55.4	9.5	57.7
D 12	0 53.0	N17 20.4	284 06.4	9.8	N16 45.9	9.7	57.7
A 13	15 53.0	21.1	298 35.2	9.9	16 36.2	9.7	57.8
Y 14	30 53.0	21.8	313 04.1	9.9	16 26.5	9.9	57.8
15	45 53.0	. . 22.4	327 33.0	9.9	16 16.6	9.9	57.8
16	60 53.1	23.1	342 01.9	10.0	16 06.7	10.0	57.8
17	75 53.1	23.8	356 30.9	10.0	15 56.7	10.2	57.9
18	90 53.1	N17 24.4	10 59.9	10.0	N15 46.5	10.2	57.9
19	105 53.2	25.1	25 28.9	10.0	15 36.3	10.3	57.9
20	120 53.2	25.8	39 57.9	10.1	15 26.0	10.5	58.0
21	135 53.2	. . 26.4	54 27.0	10.1	15 15.5	10.5	58.0
22	150 53.2	27.1	68 56.1	10.1	15 05.0	10.6	58.0
23	165 53.3	27.7	83 25.2	10.1	N14 54.4	10.7	58.0
	SD 15.9	d 0.7	SD	15.4	15.6		15.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 7	Moonrise 8	Moonrise 9	Moonrise 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	00 34			05 40	08 46
N 70	////	////	01 49			06 55	09 12
68	////	////	02 26		05 22	07 32	09 31
66	////	01 07	02 51	04 27	06 10	07 58	09 46
64	////	01 53	03 11	05 13	06 41	08 18	09 59
62	////	02 22	03 27	05 42	07 04	08 34	10 09
60	01 00	02 43	03 41	06 05	07 22	08 48	10 18
N 58	01 41	03 01	03 52	06 23	07 37	08 59	10 26
56	02 08	03 15	04 02	06 39	07 50	09 09	10 33
54	02 28	03 27	04 11	06 52	08 02	09 18	10 39
52	02 44	03 38	04 18	07 03	08 12	09 26	10 44
50	02 58	03 47	04 25	07 13	08 20	09 33	10 49
45	03 25	04 07	04 40	07 35	08 39	09 48	11 00
N 40	03 46	04 22	04 52	07 52	08 54	10 00	11 09
35	04 02	04 35	05 03	08 07	09 07	10 11	11 16
30	04 15	04 46	05 12	08 19	09 19	10 20	11 23
20	04 36	05 04	05 27	08 41	09 38	10 36	11 34
N 10	04 53	05 19	05 41	08 59	09 54	10 49	11 44
0	05 06	05 31	05 53	09 17	10 10	11 02	11 53
S 10	05 18	05 43	06 05	09 34	10 25	11 15	12 03
20	05 29	05 55	06 18	09 53	10 42	11 28	12 12
30	05 39	06 08	06 33	10 14	11 01	11 44	12 24
35	05 45	06 15	06 42	10 26	11 12	11 53	12 30
40	05 50	06 23	06 51	10 41	11 24	12 03	12 37
45	05 56	06 31	07 03	10 58	11 39	12 15	12 46
S 50	06 03	06 41	07 16	11 19	11 57	12 29	12 56
52	06 05	06 46	07 23	11 29	12 06	12 36	13 01
54	06 08	06 51	07 30	11 40	12 16	12 43	13 06
56	06 11	06 56	07 38	11 53	12 26	12 52	13 12
58	06 15	07 02	07 46	12 08	12 39	13 01	13 18
S 60	06 18	07 09	07 57	12 25	12 53	13 11	13 25

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 7	Moonset 8	Moonset 9	Moonset 10
°	h m	h m	h m	h m	h m	h m	h m
N 72						04 14	02 56
N 70	22 10	////	////			02 58	02 29
68	21 31	////	////		02 40	02 19	02 08
66	21 05	22 55	////	01 43	01 51	01 52	01 51
64	20 44	22 05	////	00 57	01 20	01 31	01 38
62	20 28	21 35	////	00 27	00 56	01 14	01 26
60	20 14	21 12	23 01	00 04	00 37	01 00	01 16
N 58	20 03	20 55	22 16	24 22	00 22	00 48	01 08
56	19 53	20 40	21 48	24 08	00 08	00 37	01 00
54	19 44	20 27	21 27	23 57	24 28	00 28	00 53
52	19 36	20 16	21 11	23 46	24 20	00 20	00 47
50	19 29	20 07	20 56	23 37	24 12	00 12	00 41
45	19 14	19 47	20 29	23 18	23 56	24 29	00 29
N 40	19 01	19 31	20 08	23 02	23 43	24 19	00 19
35	18 51	19 18	19 52	22 48	23 31	24 10	00 10
30	18 42	19 07	19 38	22 37	23 21	24 03	00 03
20	18 26	18 49	19 17	22 16	23 04	23 49	24 32
N 10	18 13	18 35	19 00	21 59	22 49	23 38	24 25
0	18 00	18 22	18 47	21 42	22 35	23 27	24 17
S 10	17 48	18 10	18 35	21 26	22 21	23 16	24 10
20	17 34	17 57	18 24	21 08	22 05	23 04	24 02
30	17 20	17 45	18 13	20 47	21 48	22 50	23 53
35	17 11	17 38	18 08	20 35	21 37	22 42	23 48
40	17 01	17 30	18 02	20 21	21 26	22 33	23 42
45	16 50	17 21	17 56	20 05	21 11	22 22	23 34
S 50	16 36	17 11	17 50	19 44	20 54	22 09	23 26
52	16 30	17 06	17 47	19 34	20 46	22 03	23 22
54	16 23	17 01	17 44	19 23	20 37	21 56	23 18
56	16 15	16 56	17 41	19 11	20 27	21 48	23 13
58	16 06	16 50	17 38	18 56	20 15	21 40	23 07
S 60	15 56	16 43	17 34	18 39	20 01	21 30	23 01

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
7	03 23	03 25	11 57	15 29	03 03	04	17
8	03 27	03 29	11 57	16 22	03 56	05	25
9	03 30	03 32	11 56	17 14	04 49	06	35

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
10 00	227 27.1	205 43.6	N 7 19.3	200 14.4	N10 31.5	204 27.2	N 8 26.6	35 55.8	S 2 01.8
01	242 29.6	220 43.2	20.5	215 15.0	32.2	219 29.1	26.8	50 58.4	01.8
02	257 32.0	235 42.8	21.6	230 15.7	32.9	234 31.0	27.0	66 01.0	01.7
03	272 34.5	250 42.5	. . 22.7	245 16.4	. . 33.6	249 32.9	. . 27.2	81 03.6	. . 01.7
04	287 36.9	265 42.1	23.8	260 17.1	34.3	264 34.9	27.4	96 06.2	01.7
05	302 39.4	280 41.7	25.0	275 17.8	35.0	279 36.8	27.6	111 08.8	01.6
06	317 41.9	295 41.3	N 7 26.1	290 18.4	N10 35.7	294 38.7	N 8 27.8	126 11.4	S 2 01.6
07	332 44.3	310 41.0	27.2	305 19.1	36.4	309 40.6	28.0	141 13.9	01.5
08	347 46.8	325 40.6	28.4	320 19.8	37.0	324 42.5	28.2	156 16.5	01.5
T 09	2 49.3	340 40.2	. . 29.5	335 20.5	. . 37.7	339 44.5	. . 28.4	171 19.1	. . 01.4
U 10	17 51.7	355 39.9	30.6	350 21.2	38.4	354 46.4	28.6	186 21.7	01.4
E 11	32 54.2	10 39.5	31.7	5 21.8	39.1	9 48.3	28.9	201 24.3	01.3
S 12	47 56.7	25 39.1	N 7 32.9	20 22.5	N10 39.8	24 50.2	N 8 29.1	216 26.9	S 2 01.3
D 13	62 59.1	40 38.7	34.0	35 23.2	40.5	39 52.2	29.3	231 29.5	01.2
A 14	78 01.6	55 38.4	35.1	50 23.9	41.2	54 54.1	29.5	246 32.0	01.2
Y 15	93 04.1	70 38.0	. . 36.2	65 24.5	. . 41.8	69 56.0	. . 29.7	261 34.6	. . 01.2
16	108 06.5	85 37.6	37.4	80 25.2	42.5	84 57.9	29.9	276 37.2	01.1
17	123 09.0	100 37.2	38.5	95 25.9	43.2	99 59.9	30.1	291 39.8	01.1
18	138 11.4	115 36.9	N 7 39.6	110 26.6	N10 43.9	115 01.8	N 8 30.3	306 42.4	S 2 01.0
19	153 13.9	130 36.5	40.8	125 27.3	44.6	130 03.7	30.5	321 45.0	01.0
20	168 16.4	145 36.1	41.9	140 27.9	45.3	145 05.6	30.7	336 47.6	00.9
21	183 18.8	160 35.7	. . 43.0	155 28.6	. . 46.0	160 07.5	. . 30.9	351 50.2	. . 00.9
22	198 21.3	175 35.4	44.1	170 29.3	46.6	175 09.5	31.1	6 52.7	00.9
23	213 23.8	190 35.0	45.3	185 30.0	47.3	190 11.4	31.3	21 55.3	00.8
11 00	228 26.2	205 34.6	N 7 46.4	200 30.6	N10 48.0	205 13.3	N 8 31.6	36 57.9	S 2 00.8
01	243 28.7	220 34.2	47.5	215 31.3	48.7	220 15.2	31.8	52 00.5	00.7
02	258 31.2	235 33.8	48.6	230 32.0	49.4	235 17.2	32.0	67 03.1	00.7
03	273 33.6	250 33.5	. . 49.7	245 32.7	. . 50.1	250 19.1	. . 32.2	82 05.7	. . 00.6
04	288 36.1	265 33.1	50.9	260 33.4	50.7	265 21.0	32.4	97 08.3	00.6
05	303 38.6	280 32.7	52.0	275 34.0	51.4	280 22.9	32.6	112 10.8	00.5
06	318 41.0	295 32.3	N 7 53.1	290 34.7	N10 52.1	295 24.9	N 8 32.8	127 13.4	S 2 00.5
W 07	333 43.5	310 32.0	54.2	305 35.4	52.8	310 26.8	33.0	142 16.0	00.5
E 08	348 45.9	325 31.6	55.4	320 36.1	53.5	325 28.7	33.2	157 18.6	00.4
D 09	3 48.4	340 31.2	. . 56.5	335 36.7	. . 54.1	340 30.6	. . 33.4	172 21.2	. . 00.4
N 10	18 50.9	355 30.8	57.6	350 37.4	54.8	355 32.6	33.6	187 23.8	00.3
E 11	33 53.3	10 30.4	58.7	5 38.1	55.5	10 34.5	33.8	202 26.3	00.3
S 12	48 55.8	25 30.1	N 7 59.8	20 38.8	N10 56.2	25 36.4	N 8 34.0	217 28.9	S 2 00.2
D 13	63 58.3	40 29.7	8 01.0	35 39.4	56.9	40 38.3	34.2	232 31.5	00.2
A 14	79 00.7	55 29.3	02.1	50 40.1	57.6	55 40.3	34.5	247 34.1	00.2
Y 15	94 03.2	70 28.9	. . 03.2	65 40.8	. . 58.2	70 42.2	. . 34.7	262 36.7	. . 00.1
16	109 05.7	85 28.5	04.3	80 41.5	58.9	85 44.1	34.9	277 39.3	00.1
17	124 08.1	100 28.1	05.4	95 42.2	10 59.6	100 46.0	35.1	292 41.8	00.0
18	139 10.6	115 27.8	N 8 06.6	110 42.8	N11 00.3	115 48.0	N 8 35.3	307 44.4	S 2 00.0
19	154 13.0	130 27.4	07.7	125 43.5	01.0	130 49.9	35.5	322 47.0	1 59.9
20	169 15.5	145 27.0	08.8	140 44.2	01.6	145 51.8	35.7	337 49.6	59.9
21	184 18.0	160 26.6	. . 09.9	155 44.9	. . 02.3	160 53.7	. . 35.9	352 52.2	. . 59.9
22	199 20.4	175 26.2	11.0	170 45.5	03.0	175 55.7	36.1	7 54.8	59.8
23	214 22.9	190 25.9	12.2	185 46.2	03.7	190 57.6	36.3	22 57.3	59.8
12 00	229 25.4	205 25.5	N 8 13.3	200 46.9	N11 04.3	205 59.5	N 8 36.5	37 59.9	S 1 59.7
01	244 27.8	220 25.1	14.4	215 47.6	05.0	221 01.4	36.7	53 02.5	59.7
02	259 30.3	235 24.7	15.5	230 48.2	05.7	236 03.4	36.9	68 05.1	59.6
03	274 32.8	250 24.3	. . 16.6	245 48.9	. . 06.4	251 05.3	. . 37.1	83 07.7	. . 59.6
04	289 35.2	265 23.9	17.7	260 49.6	07.1	266 07.2	37.3	98 10.3	59.6
05	304 37.7	280 23.6	18.9	275 50.3	07.7	281 09.1	37.5	113 12.8	59.5
06	319 40.2	295 23.2	N 8 20.0	290 50.9	N11 08.4	296 11.1	N 8 37.8	128 15.4	S 1 59.5
07	334 42.6	310 22.8	21.1	305 51.6	09.1	311 13.0	38.0	143 18.0	59.4
T 08	349 45.1	325 22.4	22.2	320 52.3	09.8	326 14.9	38.2	158 20.6	59.4
H 09	4 47.5	340 22.0	. . 23.3	335 53.0	. . 10.4	341 16.8	. . 38.4	173 23.2	. . 59.4
U 10	19 50.0	355 21.6	24.4	350 53.6	11.1	356 18.8	38.6	188 25.8	59.3
R 11	34 52.5	10 21.2	25.6	5 54.3	11.8	11 20.7	38.8	203 28.3	59.3
S 12	49 54.9	25 20.9	N 8 26.7	20 55.0	N11 12.5	26 22.6	N 8 39.0	218 30.9	S 1 59.2
D 13	64 57.4	40 20.5	27.8	35 55.7	13.2	41 24.5	39.2	233 33.5	59.2
A 14	79 59.9	55 20.1	28.9	50 56.4	13.8	56 26.5	39.4	248 36.1	59.1
Y 15	95 02.3	70 19.7	. . 30.0	65 57.0	. . 14.5	71 28.4	. . 39.6	263 38.7	. . 59.1
16	110 04.8	85 19.3	31.1	80 57.7	15.2	86 30.3	39.8	278 41.2	59.1
17	125 07.3	100 18.9	32.2	95 58.4	15.9	101 32.2	40.0	293 43.8	59.0
18	140 09.7	115 18.5	N 8 33.3	110 59.1	N11 16.5	116 34.2	N 8 40.2	308 46.4	S 1 59.0
19	155 12.2	130 18.1	34.5	125 59.7	17.2	131 36.1	40.4	323 49.0	58.9
20	170 14.7	145 17.8	35.6	141 00.4	17.9	146 38.0	40.6	338 51.6	58.9
21	185 17.1	160 17.4	. . 36.7	156 01.1	. . 18.5	161 39.9	. . 40.8	353 54.1	. . 58.9
22	200 19.6	175 17.0	37.8	171 01.8	19.2	176 41.9	41.0	8 56.7	58.8
23	215 22.0	190 16.6	38.9	186 02.4	19.9	191 43.8	41.3	23 59.3	58.8
	h m								
Mer. Pass.	8 44.8	v −0.4	d 1.1	v 0.7	d 0.7	v 1.9	d 0.2	v 2.6	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.5
Achernar	335 28.3	S57 10.6
Acrux	173 10.6	S63 10.1
Adhara	255 13.9	S28 59.5
Aldebaran	290 51.4	N16 31.8
Alioth	166 21.5	N55 53.9
Alkaid	152 59.6	N49 15.4
Al Na'ir	27 45.6	S46 54.1
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.5
Alpheratz	357 45.3	N29 09.1
Altair	62 09.6	N 8 53.9
Ankaa	353 17.4	S42 14.5
Antares	112 27.8	S26 27.4
Arcturus	145 56.8	N19 07.3
Atria	107 30.5	S69 02.8
Avior	234 18.9	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.2	S52 42.4
Capella	280 37.1	N46 00.6
Deneb	49 32.4	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.6	S17 55.4
Dubhe	193 53.1	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.4	N51 29.1
Enif	33 48.6	N 9 55.6
Fomalhaut	15 25.7	S29 33.5
Gacrux	172 02.2	S57 10.9
Gienah	175 53.6	S17 36.6
Hadar	148 49.5	S60 25.9
Hamal	328 02.8	N23 30.9
Kaus Aust.	83 45.5	S34 22.6
Kochab	137 18.6	N74 06.5
Markab	13 40.0	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.0	S36 25.7
Miaplacidus	221 40.2	S69 46.3
Mirfak	308 43.1	N49 54.0
Nunki	75 59.9	S26 16.8
Peacock	53 21.4	S56 41.6
Pollux	243 29.7	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.6	N12 33.0
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.5
Rigil Kent.	139 53.2	S60 53.0
Sabik	102 14.0	S15 44.3
Schedar	349 42.8	N56 35.8
Shaula	96 23.6	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.6	S43 29.1
Vega	80 39.7	N38 47.5
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	337 08.4	10 18
Mars	332 04.4	10 37
Jupiter	336 47.1	10 18
Saturn	168 31.7	21 28

UT	SUN				MOON						
	GHA		Dec		GHA	v		Dec		d	HP
d h	°	′	°	′	°	′	′	°	′	′	′
10 00	180	53.3	N17	28.4	97	54.3	10.2	N14	43.7	10.7	58.1
01	195	53.3		29.1	112	23.5	10.2	14	33.0	10.9	58.1
02	210	53.3		29.7	126	52.7	10.2	14	22.1	11.0	58.1
03	225	53.4	. .	30.4	141	21.9	10.2	14	11.1	11.0	58.1
04	240	53.4		31.0	155	51.1	10.3	14	00.1	11.1	58.2
05	255	53.4		31.7	170	20.4	10.3	13	49.0	11.2	58.2
06	270	53.4	N17	32.4	184	49.7	10.3	N13	37.8	11.3	58.2
07	285	53.5		33.0	199	19.0	10.3	13	26.5	11.4	58.2
T 08	300	53.5		33.7	213	48.3	10.4	13	15.1	11.5	58.3
U 09	315	53.5	. .	34.3	228	17.7	10.3	13	03.6	11.5	58.3
E 10	330	53.5		35.0	242	47.0	10.4	12	52.1	11.6	58.3
S 11	345	53.6		35.6	257	16.4	10.4	12	40.5	11.7	58.4
D 12	0	53.6	N17	36.3	271	45.8	10.5	N12	28.8	11.8	58.4
A 13	15	53.6		37.0	286	15.3	10.4	12	17.0	11.8	58.4
Y 14	30	53.6		37.6	300	44.7	10.5	12	05.2	12.0	58.4
15	45	53.7	. .	38.3	315	14.2	10.5	11	53.2	12.0	58.5
16	60	53.7		38.9	329	43.7	10.5	11	41.2	12.0	58.5
17	75	53.7		39.6	344	13.2	10.5	11	29.2	12.2	58.5
18	90	53.7	N17	40.2	358	42.7	10.6	N11	17.0	12.2	58.5
19	105	53.7		40.9	13	12.3	10.5	11	04.8	12.3	58.6
20	120	53.8		41.5	27	41.8	10.6	10	52.5	12.4	58.6
21	135	53.8	. .	42.2	42	11.4	10.6	10	40.1	12.4	58.6
22	150	53.8		42.8	56	41.0	10.6	10	27.7	12.5	58.7
23	165	53.8		43.5	71	10.6	10.6	10	15.2	12.5	58.7
11 00	180	53.9	N17	44.1	85	40.2	10.6	N10	02.7	12.7	58.7
01	195	53.9		44.8	100	09.8	10.6	9	50.0	12.7	58.7
02	210	53.9		45.4	114	39.4	10.7	9	37.3	12.7	58.8
03	225	53.9	. .	46.1	129	09.1	10.7	9	24.6	12.8	58.8
04	240	53.9		46.7	143	38.8	10.6	9	11.8	12.9	58.8
05	255	54.0		47.4	158	08.4	10.7	8	58.9	13.0	58.8
06	270	54.0	N17	48.0	172	38.1	10.7	N 8	45.9	13.0	58.9
W 07	285	54.0		48.7	187	07.8	10.7	8	32.9	13.0	58.9
E 08	300	54.0		49.3	201	37.5	10.7	8	19.9	13.1	58.9
D 09	315	54.0	. .	49.9	216	07.2	10.7	8	06.8	13.2	58.9
N 10	330	54.0		50.6	230	36.9	10.7	7	53.6	13.2	59.0
E 11	345	54.1		51.2	245	06.6	10.7	7	40.4	13.3	59.0
S 12	0	54.1	N17	51.9	259	36.3	10.7	N 7	27.1	13.3	59.0
D 13	15	54.1		52.5	274	06.0	10.8	7	13.8	13.4	59.0
A 14	30	54.1		53.2	288	35.8	10.7	7	00.4	13.4	59.1
Y 15	45	54.1	. .	53.8	303	05.5	10.7	6	47.0	13.5	59.1
16	60	54.1		54.4	317	35.2	10.7	6	33.5	13.5	59.1
17	75	54.2		55.1	332	04.9	10.8	6	20.0	13.6	59.2
18	90	54.2	N17	55.7	346	34.7	10.7	N 6	06.4	13.6	59.2
19	105	54.2		56.4	1	04.4	10.7	5	52.8	13.7	59.2
20	120	54.2		57.0	15	34.1	10.7	5	39.1	13.7	59.2
21	135	54.2	. .	57.6	30	03.8	10.7	5	25.4	13.7	59.3
22	150	54.2		58.3	44	33.5	10.8	5	11.7	13.8	59.3
23	165	54.3		58.9	59	03.3	10.7	4	57.9	13.8	59.3
12 00	180	54.3	N17	59.5	73	33.0	10.7	N 4	44.1	13.9	59.3
01	195	54.3	18	00.2	88	02.7	10.6	4	30.2	13.9	59.4
02	210	54.3		00.8	102	32.3	10.7	4	16.3	13.9	59.4
03	225	54.3	. .	01.5	117	02.0	10.7	4	02.4	14.0	59.4
04	240	54.3		02.1	131	31.7	10.7	3	48.4	14.0	59.4
05	255	54.3		02.7	146	01.4	10.6	3	34.4	14.0	59.4
06	270	54.4	N18	03.4	160	31.0	10.6	N 3	20.4	14.0	59.5
07	285	54.4		04.0	175	00.6	10.7	3	06.4	14.1	59.5
T 08	300	54.4		04.6	189	30.3	10.6	2	52.3	14.2	59.5
H 09	315	54.4	. .	05.2	203	59.9	10.6	2	38.1	14.1	59.5
U 10	330	54.4		05.9	218	29.5	10.6	2	24.0	14.2	59.6
R 11	345	54.4		06.5	232	59.1	10.5	2	09.8	14.2	59.6
S 12	0	54.4	N18	07.1	247	28.6	10.6	N 1	55.6	14.2	59.6
D 13	15	54.4		07.8	261	58.2	10.5	1	41.4	14.2	59.6
A 14	30	54.5		08.4	276	27.7	10.5	1	27.2	14.2	59.7
Y 15	45	54.5	. .	09.0	290	57.2	10.5	1	13.0	14.3	59.7
16	60	54.5		09.7	305	26.7	10.4	0	58.7	14.3	59.7
17	75	54.5		10.3	319	56.1	10.5	0	44.4	14.3	59.7
18	90	54.5	N18	10.9	334	25.6	10.4	N 0	30.1	14.3	59.7
19	105	54.5		11.5	348	55.0	10.4	0	15.8	14.4	59.8
20	120	54.5		12.2	3	24.4	10.4	N 0	01.4	14.3	59.8
21	135	54.5	. .	12.8	17	53.8	10.3	S 0	12.9	14.3	59.8
22	150	54.5		13.4	32	23.1	10.3	0	27.2	14.4	59.8
23	165	54.6		14.0	46	52.4	10.3	S 0	41.6	14.4	59.9
	SD	15.9	d	0.6	SD	15.9			16.1		16.2

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 10	Moonrise 11	Moonrise 12	Moonrise 13
°	h m	h m	h m	h m	h m	h m	h m
N 72				08 46	11 04	13 15	15 26
N 70	////	////	01 26	09 12	11 16	13 17	15 19
68	////	////	02 11	09 31	11 25	13 18	15 13
66	////	00 31	02 40	09 46	11 33	13 20	15 09
64	////	01 36	03 01	09 59	11 39	13 21	15 05
62	////	02 09	03 19	10 09	11 45	13 22	15 01
60	00 28	02 33	03 33	10 18	11 50	13 23	14 58
N 58	01 26	02 52	03 45	10 26	11 54	13 24	14 56
56	01 57	03 08	03 56	10 33	11 58	13 25	14 53
54	02 19	03 21	04 05	10 39	12 01	13 25	14 51
52	02 37	03 32	04 13	10 44	12 04	13 26	14 49
50	02 52	03 42	04 21	10 49	12 07	13 26	14 48
45	03 20	04 03	04 36	11 00	12 13	13 28	14 44
N 40	03 42	04 19	04 49	11 09	12 18	13 29	14 41
35	03 59	04 32	05 00	11 16	12 22	13 29	14 38
30	04 13	04 44	05 10	11 23	12 26	13 30	14 36
20	04 35	05 02	05 26	11 34	12 33	13 32	14 32
N 10	04 52	05 18	05 40	11 44	12 38	13 33	14 28
0	05 06	05 31	05 53	11 53	12 44	13 34	14 25
S 10	05 18	05 44	06 06	12 03	12 49	13 35	14 22
20	05 30	05 56	06 20	12 12	12 55	13 36	14 18
30	05 41	06 10	06 35	12 24	13 01	13 38	14 15
35	05 47	06 17	06 44	12 30	13 05	13 39	14 13
40	05 53	06 25	06 54	12 37	13 09	13 39	14 10
45	05 59	06 35	07 06	12 46	13 14	13 41	14 07
S 50	06 06	06 45	07 21	12 56	13 20	13 42	14 04
52	06 09	06 50	07 27	13 01	13 22	13 42	14 03
54	06 13	06 56	07 35	13 06	13 25	13 43	14 01
56	06 16	07 01	07 43	13 12	13 28	13 44	13 59
58	06 20	07 08	07 53	13 18	13 32	13 45	13 57
S 60	06 24	07 15	08 03	13 25	13 36	13 45	13 55

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 10	Moonset 11	Moonset 12	Moonset 13
°	h m	h m	h m	h m	h m	h m	h m
N 72				02 56	02 24	02 01	01 39
N 70	22 34	////	////	02 29	02 10	01 55	01 41
68	21 46	////	////	02 08	01 59	01 51	01 43
66	21 16	23 50	////	01 51	01 49	01 47	01 44
64	20 54	22 22	////	01 38	01 41	01 44	01 46
62	20 36	21 47	////	01 26	01 34	01 41	01 47
60	20 22	21 22	23 50	01 16	01 28	01 38	01 47
N 58	20 09	21 03	22 31	01 08	01 23	01 36	01 48
56	19 58	20 47	21 59	01 00	01 18	01 34	01 49
54	19 49	20 33	21 36	00 53	01 14	01 32	01 50
52	19 41	20 22	21 18	00 47	01 10	01 30	01 50
50	19 33	20 12	21 03	00 41	01 06	01 29	01 51
45	19 17	19 51	20 34	00 29	00 58	01 25	01 52
N 40	19 04	19 35	20 12	00 19	00 52	01 23	01 53
35	18 53	19 21	19 55	00 10	00 46	01 20	01 54
30	18 44	19 10	19 41	00 03	00 41	01 18	01 55
20	18 27	18 51	19 18	24 32	00 32	01 14	01 56
N 10	18 13	18 35	19 01	24 25	00 25	01 11	01 57
0	18 00	18 22	18 47	24 17	00 17	01 07	01 58
S 10	17 47	18 09	18 34	24 10	00 10	01 04	01 59
20	17 33	17 56	18 23	24 02	00 02	01 01	02 00
30	17 17	17 43	18 11	23 53	24 57	00 57	02 01
35	17 08	17 35	18 06	23 48	24 54	00 54	02 02
40	16 58	17 27	18 00	23 42	24 51	00 51	02 03
45	16 46	17 18	17 53	23 34	24 48	00 48	02 04
S 50	16 32	17 07	17 46	23 26	24 45	00 45	02 05
52	16 25	17 02	17 43	23 22	24 43	00 43	02 05
54	16 17	16 57	17 40	23 18	24 41	00 41	02 06
56	16 09	16 51	17 36	23 13	24 39	00 39	02 06
58	15 59	16 44	17 32	23 07	24 36	00 36	02 07
S 60	15 49	16 37	17 28	23 01	24 34	00 34	02 08

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
10	03 33	03 34	11 56	18 05	05 40	07	46
11	03 35	03 36	11 56	18 56	06 30	08	57
12	03 37	03 38	11 56	19 46	07 21	09	68

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.6	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
13 00	230 24.5	205 16.2	N 8 40.0	201 03.1	N11 20.6	206 45.7	N 8 41.5	39 01.9	S 1 58.7
01	245 27.0	220 15.8	41.1	216 03.8	21.2	221 47.7	41.7	54 04.5	58.7
02	260 29.4	235 15.4	42.2	231 04.5	21.9	236 49.6	41.9	69 07.0	58.7
03	275 31.9	250 15.0	43.3	246 05.1	22.6	251 51.5	42.1	84 09.6	58.6
04	290 34.4	265 14.6	44.5	261 05.8	23.3	266 53.4	42.3	99 12.2	58.6
05	305 36.8	280 14.2	45.6	276 06.5	23.9	281 55.4	42.5	114 14.8	58.5
06	320 39.3	295 13.9	N 8 46.7	291 07.2	N11 24.6	296 57.3	N 8 42.7	129 17.4	S 1 58.5
07	335 41.8	310 13.5	47.8	306 07.8	25.3	311 59.2	42.9	144 19.9	58.4
08	350 44.2	325 13.1	48.9	321 08.5	26.0	327 01.1	43.1	159 22.5	58.4
F 09	5 46.7	340 12.7	50.0	336 09.2	26.6	342 03.1	43.3	174 25.1	58.4
R 10	20 49.1	355 12.3	51.1	351 09.9	27.3	357 05.0	43.5	189 27.7	58.3
I 11	35 51.6	10 11.9	52.2	6 10.5	28.0	12 06.9	43.7	204 30.2	58.3
D 12	50 54.1	25 11.5	N 8 53.3	21 11.2	N11 28.6	27 08.8	N 8 43.9	219 32.8	S 1 58.2
A 13	65 56.5	40 11.1	54.4	36 11.9	29.3	42 10.8	44.1	234 35.4	58.2
Y 14	80 59.0	55 10.7	55.5	51 12.5	30.0	57 12.7	44.3	249 38.0	58.2
15	96 01.5	70 10.3	56.6	66 13.2	30.6	72 14.6	44.5	264 40.6	58.1
16	111 03.9	85 09.9	57.7	81 13.9	31.3	87 16.6	44.7	279 43.1	58.1
17	126 06.4	100 09.5	8 58.8	96 14.6	32.0	102 18.5	44.9	294 45.7	58.0
18	141 08.9	115 09.1	N 9 00.0	111 15.2	N11 32.7	117 20.4	N 8 45.1	309 48.3	S 1 58.0
19	156 11.3	130 08.7	01.1	126 15.9	33.3	132 22.3	45.3	324 50.9	58.0
20	171 13.8	145 08.3	02.2	141 16.6	34.0	147 24.3	45.6	339 53.4	57.9
21	186 16.3	160 08.0	03.3	156 17.3	34.7	162 26.2	45.8	354 56.0	57.9
22	201 18.7	175 07.6	04.4	171 17.9	35.3	177 28.1	46.0	9 58.6	57.8
23	216 21.2	190 07.2	05.5	186 18.6	36.0	192 30.1	46.2	25 01.2	57.8
14 00	231 23.6	205 06.8	N 9 06.6	201 19.3	N11 36.7	207 32.0	N 8 46.4	40 03.8	S 1 57.8
01	246 26.1	220 06.4	07.7	216 20.0	37.3	222 33.9	46.6	55 06.3	57.7
02	261 28.6	235 06.0	08.8	231 20.6	38.0	237 35.8	46.8	70 08.9	57.7
03	276 31.0	250 05.6	09.9	246 21.3	38.7	252 37.8	47.0	85 11.5	57.7
04	291 33.5	265 05.2	11.0	261 22.0	39.3	267 39.7	47.2	100 14.1	57.6
05	306 36.0	280 04.8	12.1	276 22.7	40.0	282 41.6	47.4	115 16.6	57.6
06	321 38.4	295 04.4	N 9 13.2	291 23.3	N11 40.7	297 43.6	N 8 47.6	130 19.2	S 1 57.5
07	336 40.9	310 04.0	14.3	306 24.0	41.3	312 45.5	47.8	145 21.8	57.5
S 08	351 43.4	325 03.6	15.4	321 24.7	42.0	327 47.4	48.0	160 24.4	57.5
A 09	6 45.8	340 03.2	16.5	336 25.3	42.7	342 49.3	48.2	175 26.9	57.4
T 10	21 48.3	355 02.8	17.6	351 26.0	43.3	357 51.3	48.4	190 29.5	57.4
U 11	36 50.7	10 02.4	18.7	6 26.7	44.0	12 53.2	48.6	205 32.1	57.3
R 12	51 53.2	25 02.0	N 9 19.8	21 27.4	N11 44.7	27 55.1	N 8 48.8	220 34.7	S 1 57.3
D 13	66 55.7	40 01.6	20.9	36 28.0	45.3	42 57.1	49.0	235 37.2	57.3
A 14	81 58.1	55 01.2	22.0	51 28.7	46.0	57 59.0	49.2	250 39.8	57.2
Y 15	97 00.6	70 00.8	23.1	66 29.4	46.7	73 00.9	49.4	265 42.4	57.2
16	112 03.1	85 00.4	24.2	81 30.1	47.3	88 02.8	49.6	280 45.0	57.1
17	127 05.5	100 00.0	25.3	96 30.7	48.0	103 04.8	49.8	295 47.5	57.1
18	142 08.0	114 59.6	N 9 26.4	111 31.4	N11 48.7	118 06.7	N 8 50.0	310 50.1	S 1 57.1
19	157 10.5	129 59.2	27.5	126 32.1	49.3	133 08.6	50.2	325 52.7	57.0
20	172 12.9	144 58.8	28.6	141 32.7	50.0	148 10.6	50.4	340 55.3	57.0
21	187 15.4	159 58.4	29.7	156 33.4	50.7	163 12.5	50.6	355 57.8	57.0
22	202 17.9	174 58.0	30.8	171 34.1	51.3	178 14.4	50.8	11 00.4	56.9
23	217 20.3	189 57.6	31.9	186 34.8	52.0	193 16.3	51.1	26 03.0	56.9
15 00	232 22.8	204 57.2	N 9 32.9	201 35.4	N11 52.6	208 18.3	N 8 51.3	41 05.6	S 1 56.8
01	247 25.2	219 56.8	34.0	216 36.1	53.3	223 20.2	51.5	56 08.1	56.8
02	262 27.7	234 56.4	35.1	231 36.8	54.0	238 22.1	51.7	71 10.7	56.8
03	277 30.2	249 56.0	36.2	246 37.5	54.6	253 24.1	51.9	86 13.3	56.7
04	292 32.6	264 55.5	37.3	261 38.1	55.3	268 26.0	52.1	101 15.8	56.7
05	307 35.1	279 55.1	38.4	276 38.8	56.0	283 27.9	52.3	116 18.4	56.7
06	322 37.6	294 54.7	N 9 39.5	291 39.5	N11 56.6	298 29.9	N 8 52.5	131 21.0	S 1 56.6
07	337 40.0	309 54.3	40.6	306 40.1	57.3	313 31.8	52.7	146 23.6	56.6
08	352 42.5	324 53.9	41.7	321 40.8	57.9	328 33.7	52.9	161 26.1	56.5
S 09	7 45.0	339 53.5	42.8	336 41.5	58.6	343 35.6	53.1	176 28.7	56.5
U 10	22 47.4	354 53.1	43.9	351 42.2	59.3	358 37.6	53.3	191 31.3	56.5
N 11	37 49.9	9 52.7	45.0	6 42.8	11 59.9	13 39.5	53.5	206 33.8	56.4
D 12	52 52.4	24 52.3	N 9 46.1	21 43.5	N12 00.6	28 41.4	N 8 53.7	221 36.4	S 1 56.4
A 13	67 54.8	39 51.9	47.2	36 44.2	01.2	43 43.4	53.9	236 39.0	56.4
Y 14	82 57.3	54 51.5	48.2	51 44.8	01.9	58 45.3	54.1	251 41.6	56.3
15	97 59.7	69 51.1	49.3	66 45.5	02.6	73 47.2	54.3	266 44.1	56.3
16	113 02.2	84 50.7	50.4	81 46.2	03.2	88 49.2	54.5	281 46.7	56.2
17	128 04.7	99 50.3	51.5	96 46.9	03.9	103 51.1	54.7	296 49.3	56.2
18	143 07.1	114 49.8	N 9 52.6	111 47.5	N12 04.5	118 53.0	N 8 54.9	311 51.9	S 1 56.2
19	158 09.6	129 49.4	53.7	126 48.2	05.2	133 55.0	55.1	326 54.4	56.1
20	173 12.1	144 49.0	54.8	141 48.9	05.9	148 56.9	55.3	341 57.0	56.1
21	188 14.5	159 48.6	55.9	156 49.5	06.5	163 58.8	55.5	356 59.6	56.1
22	203 17.0	174 48.2	57.0	171 50.2	07.2	179 00.7	55.7	12 02.1	56.0
23	218 19.5	189 47.8	58.0	186 50.9	07.8	194 02.7	55.9	27 04.7	56.0
	h m								
Mer. Pass.	8 33.0	v −0.4	d 1.1	v 0.7	d 0.7	v 1.9	d 0.2	v 2.6	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.5
Achernar	335 28.3	S57 10.6
Acrux	173 10.6	S63 10.1
Adhara	255 14.0	S28 59.5
Aldebaran	290 51.4	N16 31.8
Alioth	166 21.5	N55 53.9
Alkaid	152 59.6	N49 15.4
Al Na'ir	27 45.6	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.5
Alpheratz	357 45.3	N29 09.1
Altair	62 09.6	N 8 53.9
Ankaa	353 17.4	S42 14.4
Antares	112 27.8	S26 27.5
Arcturus	145 56.8	N19 07.3
Atria	107 30.5	S69 02.8
Avior	234 18.9	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.2	S52 42.4
Capella	280 37.1	N46 00.6
Deneb	49 32.4	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.6	S17 55.4
Dubhe	193 53.2	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.4	N51 29.1
Enif	33 48.6	N 9 55.6
Fomalhaut	15 25.7	S29 33.5
Gacrux	172 02.3	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.5	S60 25.9
Hamal	328 02.8	N23 30.9
Kaus Aust.	83 45.5	S34 22.6
Kochab	137 18.6	N74 06.5
Markab	13 40.0	N15 15.9
Menkar	314 17.0	N 4 08.0
Menkent	148 09.0	S36 25.7
Miaplacidus	221 40.2	S69 46.3
Mirfak	308 43.1	N49 54.0
Nunki	75 59.9	S26 16.8
Peacock	53 21.4	S56 41.6
Pollux	243 29.7	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.6	N12 33.0
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.1
Sabik	102 14.0	S15 44.3
Schedar	349 42.7	N56 35.8
Shaula	96 23.6	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.7	S43 29.1
Vega	80 39.7	N38 47.5
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	333 43.1	10 20
Mars	329 55.6	10 34
Jupiter	336 08.3	10 09
Saturn	168 40.1	21 16

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
13 00	180 54.6	N18 14.7	61 21.7	10.3	S 0 56.0	14.3	59.9
01	195 54.6	15.3	75 51.0	10.2	1 10.3	14.4	59.9
02	210 54.6	15.9	90 20.2	10.2	1 24.7	14.4	59.9
03	225 54.6	16.5	104 49.4	10.1	1 39.1	14.4	59.9
04	240 54.6	17.1	119 18.5	10.2	1 53.5	14.3	60.0
05	255 54.6	17.8	133 47.7	10.1	2 07.8	14.4	60.0
06	270 54.6	N18 18.4	148 16.8	10.0	S 2 22.2	14.4	60.0
07	285 54.6	19.0	162 45.8	10.0	2 36.6	14.4	60.0
08	300 54.6	19.6	177 14.8	10.0	2 51.0	14.3	60.0
F 09	315 54.6	20.2	191 43.8	10.0	3 05.3	14.4	60.1
R 10	330 54.6	20.9	206 12.8	9.9	3 19.7	14.3	60.1
I 11	345 54.6	21.5	220 41.7	9.9	3 34.0	14.3	60.1
D 12	0 54.7	N18 22.1	235 10.6	9.8	S 3 48.3	14.4	60.1
A 13	15 54.7	22.7	249 39.4	9.8	4 02.7	14.3	60.1
Y 14	30 54.7	23.3	264 08.2	9.7	4 17.0	14.3	60.1
15	45 54.7	24.0	278 36.9	9.7	4 31.3	14.2	60.2
16	60 54.7	24.6	293 05.6	9.7	4 45.5	14.3	60.2
17	75 54.7	25.2	307 34.3	9.6	4 59.8	14.2	60.2
18	90 54.7	N18 25.8	322 02.9	9.6	S 5 14.0	14.2	60.2
19	105 54.7	26.4	336 31.5	9.5	5 28.2	14.2	60.2
20	120 54.7	27.0	351 00.0	9.5	5 42.4	14.2	60.2
21	135 54.7	27.6	5 28.5	9.4	5 56.6	14.1	60.3
22	150 54.7	28.2	19 56.9	9.4	6 10.7	14.1	60.3
23	165 54.7	28.9	34 25.3	9.3	6 24.8	14.1	60.3
14 00	180 54.7	N18 29.5	48 53.6	9.3	S 6 38.9	14.0	60.3
01	195 54.7	30.1	63 21.9	9.2	6 52.9	14.0	60.3
02	210 54.7	30.7	77 50.1	9.2	7 06.9	14.0	60.3
03	225 54.7	31.3	92 18.3	9.1	7 20.9	14.0	60.3
04	240 54.7	31.9	106 46.4	9.1	7 34.9	13.9	60.3
05	255 54.7	32.5	121 14.5	9.0	7 48.8	13.8	60.4
06	270 54.7	N18 33.1	135 42.5	8.9	S 8 02.6	13.8	60.4
S 07	285 54.7	33.7	150 10.4	8.9	8 16.4	13.8	60.4
A 08	300 54.7	34.3	164 38.3	8.9	8 30.2	13.7	60.4
T 09	315 54.7	34.9	179 06.2	8.8	8 43.9	13.7	60.4
U 10	330 54.7	35.5	193 34.0	8.7	8 57.6	13.7	60.4
R 11	345 54.7	36.1	208 01.7	8.7	9 11.3	13.6	60.4
D 12	0 54.7	N18 36.8	222 29.4	8.6	S 9 24.9	13.5	60.4
A 13	15 54.7	37.4	236 57.0	8.5	9 38.4	13.5	60.4
Y 14	30 54.7	38.0	251 24.5	8.5	9 51.9	13.4	60.5
15	45 54.7	38.6	265 52.0	8.5	10 05.3	13.4	60.5
16	60 54.7	39.2	280 19.5	8.3	10 18.7	13.3	60.5
17	75 54.7	39.8	294 46.8	8.3	10 32.0	13.2	60.5
18	90 54.7	N18 40.4	309 14.1	8.3	S10 45.2	13.2	60.5
19	105 54.7	41.0	323 41.4	8.2	10 58.4	13.1	60.5
20	120 54.7	41.6	338 08.6	8.1	11 11.5	13.1	60.5
21	135 54.7	42.2	352 35.7	8.0	11 24.6	13.0	60.5
22	150 54.7	42.8	7 02.7	8.0	11 37.6	12.9	60.5
23	165 54.7	43.4	21 29.7	8.0	11 50.5	12.8	60.5
15 00	180 54.7	N18 44.0	35 56.7	7.8	S12 03.3	12.8	60.5
01	195 54.7	44.6	50 23.5	7.8	12 16.1	12.7	60.5
02	210 54.7	45.2	64 50.3	7.8	12 28.8	12.7	60.5
03	225 54.7	45.8	79 17.1	7.6	12 41.5	12.5	60.5
04	240 54.7	46.3	93 43.7	7.6	12 54.0	12.5	60.5
05	255 54.7	46.9	108 10.3	7.6	13 06.5	12.4	60.5
06	270 54.7	N18 47.5	122 36.9	7.4	S13 18.9	12.3	60.5
07	285 54.7	48.1	137 03.3	7.4	13 31.2	12.2	60.5
08	300 54.7	48.7	151 29.7	7.4	13 43.4	12.1	60.5
S 09	315 54.7	49.3	165 56.1	7.3	13 55.5	12.1	60.5
U 10	330 54.7	49.9	180 22.4	7.2	14 07.6	11.9	60.6
N 11	345 54.7	50.5	194 48.6	7.1	14 19.5	11.9	60.6
D 12	0 54.7	N18 51.1	209 14.7	7.1	S14 31.4	11.8	60.6
A 13	15 54.7	51.7	223 40.8	7.0	14 43.2	11.7	60.6
Y 14	30 54.7	52.3	238 06.8	6.9	14 54.9	11.5	60.5
15	45 54.7	52.9	252 32.7	6.9	15 06.4	11.5	60.5
16	60 54.7	53.4	266 58.6	6.8	15 17.9	11.4	60.5
17	75 54.6	54.0	281 24.4	6.7	15 29.3	11.3	60.5
18	90 54.6	N18 54.6	295 50.1	6.7	S15 40.6	11.2	60.5
19	105 54.6	55.2	310 15.8	6.6	15 51.8	11.1	60.5
20	120 54.6	55.8	324 41.4	6.5	16 02.9	10.9	60.5
21	135 54.6	56.4	339 06.9	6.5	16 13.8	10.9	60.5
22	150 54.6	57.0	353 32.4	6.4	16 24.7	10.7	60.5
23	165 54.6	57.6	7 57.8	6.4	S16 35.4	10.7	60.5
	SD 15.9	d 0.6	SD 16.4		16.5		16.5

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 13	Moonrise 14	Moonrise 15	Moonrise 16
°	h m	h m	h m	h m	h m	h m	h m
N 72				15 26	17 48	20 41	
N 70	////	////	00 58	15 19	17 28	19 53	
68	////	////	01 55	15 13	17 14	19 22	21 47
66	////	////	02 28	15 09	17 02	19 00	21 03
64	////	01 18	02 52	15 05	16 52	18 42	20 34
62	////	01 57	03 10	15 01	16 43	18 28	20 12
60	////	02 24	03 26	14 58	16 36	18 16	19 54
N 58	01 10	02 44	03 39	14 56	16 30	18 05	19 39
56	01 46	03 01	03 50	14 53	16 24	17 56	19 27
54	02 10	03 15	04 00	14 51	16 19	17 48	19 16
52	02 30	03 27	04 08	14 49	16 15	17 41	19 06
50	02 45	03 37	04 16	14 48	16 10	17 35	18 58
45	03 16	03 59	04 33	14 44	16 02	17 21	18 39
N 40	03 38	04 16	04 46	14 41	15 54	17 10	18 24
35	03 56	04 30	04 58	14 38	15 48	17 00	18 12
30	04 10	04 41	05 08	14 36	15 43	16 52	18 01
20	04 33	05 01	05 25	14 32	15 34	16 37	17 43
N 10	04 51	05 17	05 39	14 28	15 25	16 25	17 26
0	05 06	05 31	05 53	14 25	15 18	16 13	17 11
S 10	05 19	05 44	06 06	14 22	15 10	16 02	16 57
20	05 31	05 57	06 21	14 18	15 02	15 50	16 41
30	05 43	06 12	06 37	14 15	14 54	15 36	16 23
35	05 49	06 19	06 46	14 13	14 48	15 28	16 12
40	05 55	06 28	06 57	14 10	14 43	15 19	16 00
45	06 02	06 38	07 10	14 07	14 36	15 08	15 46
S 50	06 10	06 49	07 25	14 04	14 28	14 56	15 30
52	06 13	06 54	07 32	14 03	14 24	14 50	15 22
54	06 17	07 00	07 40	14 01	14 20	14 44	15 13
56	06 21	07 06	07 49	13 59	14 16	14 36	15 03
58	06 25	07 13	07 59	13 57	14 11	14 28	14 52
S 60	06 29	07 21	08 10	13 55	14 06	14 19	14 39

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 13	Moonset 14	Moonset 15	Moonset 16
°	h m	h m	h m	h m	h m	h m	h m
N 72				01 39	01 17	{00 48 / 23 53}	
N 70	23 06	////	////	01 41	01 27	01 09	00 42
68	22 03	////	////	01 43	01 35	01 26	01 14
66	21 28	////	////	01 44	01 42	01 39	01 38
64	21 04	22 41	////	01 46	01 48	01 51	01 56
62	20 44	21 59	////	01 47	01 53	02 01	02 12
60	20 29	21 32	////	01 47	01 57	02 09	02 25
N 58	20 15	21 11	22 49	01 48	02 01	02 16	02 36
56	20 04	20 54	22 10	01 49	02 05	02 23	02 46
54	19 54	20 40	21 45	01 50	02 08	02 29	02 55
52	19 45	20 27	21 25	01 50	02 11	02 34	03 02
50	19 37	20 17	21 09	01 51	02 14	02 39	03 09
45	19 21	19 55	20 38	01 52	02 19	02 50	03 24
N 40	19 07	19 38	20 15	01 53	02 24	02 58	03 37
35	18 56	19 24	19 58	01 54	02 28	03 06	03 48
30	18 46	19 12	19 43	01 55	02 32	03 13	03 57
20	18 28	18 52	19 20	01 56	02 39	03 24	04 13
N 10	18 14	18 36	19 02	01 57	02 44	03 34	04 27
0	18 00	18 22	18 47	01 58	02 50	03 44	04 41
S 10	17 46	18 08	18 34	01 59	02 55	03 53	04 54
20	17 32	17 55	18 22	02 00	03 01	04 04	05 08
30	17 15	17 41	18 10	02 01	03 07	04 15	05 25
35	17 06	17 33	18 04	02 02	03 11	04 22	05 34
40	16 55	17 24	17 57	02 03	03 16	04 30	05 45
45	16 43	17 14	17 50	02 04	03 21	04 39	05 58
S 50	16 27	17 03	17 42	02 05	03 27	04 50	06 14
52	16 20	16 58	17 39	02 05	03 29	04 55	06 21
54	16 12	16 52	17 35	02 06	03 32	05 01	06 30
56	16 03	16 46	17 31	02 06	03 36	05 07	06 39
58	15 53	16 39	17 27	02 07	03 40	05 14	06 50
S 60	15 42	16 31	17 23	02 08	03 44	05 22	07 02

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
13	03 38	03 39	11 56	20 37	08 11	10	79
14	03 39	03 39	11 56	21 31	09 04	11	88
15	03 39	03 39	11 56	22 27	09 58	12	94

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
16 00	233 21.9	204 47.4	N 9 59.1	201 51.6	N12 08.5	209 04.6	N 8 56.1	42 07.3	S 1 55.9
01	248 24.4	219 47.0	10 00.2	216 52.2	09.1	224 06.5	56.3	57 09.8	55.9
02	263 26.8	234 46.6	01.3	231 52.9	09.8	239 08.5	56.5	72 12.4	55.9
03	278 29.3	249 46.1	. . 02.4	246 53.6	. . 10.5	254 10.4	. . 56.7	87 15.0	. . 55.8
04	293 31.8	264 45.7	03.5	261 54.2	11.1	269 12.3	56.9	102 17.6	55.8
05	308 34.2	279 45.3	04.6	276 54.9	11.8	284 14.3	57.1	117 20.1	55.8
06	323 36.7	294 44.9	N10 05.6	291 55.6	N12 12.4	299 16.2	N 8 57.3	132 22.7	S 1 55.7
07	338 39.2	309 44.5	06.7	306 56.2	13.1	314 18.1	57.5	147 25.3	55.7
08	353 41.6	324 44.1	07.8	321 56.9	13.7	329 20.1	57.7	162 27.8	55.7
M 09	8 44.1	339 43.7	. . 08.9	336 57.6	. . 14.4	344 22.0	. . 57.9	177 30.4	. . 55.6
O 10	23 46.6	354 43.3	10.0	351 58.3	15.1	359 23.9	58.1	192 33.0	55.6
N 11	38 49.0	9 42.8	11.1	6 58.9	15.7	14 25.9	58.3	207 35.5	55.5
D 12	53 51.5	24 42.4	N10 12.1	21 59.6	N12 16.4	29 27.8	N 8 58.5	222 38.1	S 1 55.5
A 13	68 54.0	39 42.0	13.2	37 00.3	17.0	44 29.7	58.7	237 40.7	55.5
Y 14	83 56.4	54 41.6	14.3	52 00.9	17.7	59 31.7	58.9	252 43.2	55.4
15	98 58.9	69 41.2	. . 15.4	67 01.6	. . 18.3	74 33.6	. . 59.1	267 45.8	. . 55.4
16	114 01.3	84 40.8	16.5	82 02.3	19.0	89 35.5	59.3	282 48.4	55.4
17	129 03.8	99 40.3	17.5	97 02.9	19.6	104 37.5	59.5	297 50.9	55.3
18	144 06.3	114 39.9	N10 18.6	112 03.6	N12 20.3	119 39.4	N 8 59.7	312 53.5	S 1 55.3
19	159 08.7	129 39.5	19.7	127 04.3	20.9	134 41.3	8 59.9	327 56.1	55.3
20	174 11.2	144 39.1	20.8	142 05.0	21.6	149 43.3	9 00.1	342 58.7	55.2
21	189 13.7	159 38.7	. . 21.9	157 05.6	. . 22.2	164 45.2	. . 00.3	358 01.2	. . 55.2
22	204 16.1	174 38.3	22.9	172 06.3	22.9	179 47.1	00.5	13 03.8	55.2
23	219 18.6	189 37.8	24.0	187 07.0	23.6	194 49.0	00.7	28 06.4	55.1
17 00	234 21.1	204 37.4	N10 25.1	202 07.6	N12 24.2	209 51.0	N 9 00.9	43 08.9	S 1 55.1
01	249 23.5	219 37.0	26.2	217 08.3	24.9	224 52.9	01.1	58 11.5	55.1
02	264 26.0	234 36.6	27.2	232 09.0	25.5	239 54.8	01.3	73 14.1	55.0
03	279 28.5	249 36.2	. . 28.3	247 09.6	. . 26.2	254 56.8	. . 01.5	88 16.6	. . 55.0
04	294 30.9	264 35.7	29.4	262 10.3	26.8	269 58.7	01.7	103 19.2	55.0
05	309 33.4	279 35.3	30.5	277 11.0	27.5	285 00.6	01.9	118 21.8	54.9
06	324 35.8	294 34.9	N10 31.5	292 11.6	N12 28.1	300 02.6	N 9 02.1	133 24.3	S 1 54.9
07	339 38.3	309 34.5	32.6	307 12.3	28.8	315 04.5	02.3	148 26.9	54.8
T 08	354 40.8	324 34.1	33.7	322 13.0	29.4	330 06.4	02.5	163 29.5	54.8
U 09	9 43.2	339 33.6	. . 34.8	337 13.6	. . 30.1	345 08.4	. . 02.7	178 32.0	. . 54.8
E 10	24 45.7	354 33.2	35.8	352 14.3	30.7	0 10.3	02.9	193 34.6	54.7
S 11	39 48.2	9 32.8	36.9	7 15.0	31.4	15 12.2	03.1	208 37.2	54.7
D 12	54 50.6	24 32.4	N10 38.0	22 15.7	N12 32.0	30 14.2	N 9 03.3	223 39.7	S 1 54.7
A 13	69 53.1	39 31.9	39.1	37 16.3	32.7	45 16.1	03.5	238 42.3	54.6
Y 14	84 55.6	54 31.5	40.1	52 17.0	33.3	60 18.1	03.7	253 44.8	54.6
15	99 58.0	69 31.1	. . 41.2	67 17.7	. . 34.0	75 20.0	. . 03.9	268 47.4	. . 54.6
16	115 00.5	84 30.7	42.3	82 18.3	34.6	90 21.9	04.1	283 50.0	54.5
17	130 03.0	99 30.2	43.4	97 19.0	35.3	105 23.9	04.3	298 52.5	54.5
18	145 05.4	114 29.8	N10 44.4	112 19.7	N12 35.9	120 25.8	N 9 04.5	313 55.1	S 1 54.5
19	160 07.9	129 29.4	45.5	127 20.3	36.6	135 27.7	04.7	328 57.7	54.4
20	175 10.3	144 29.0	46.6	142 21.0	37.2	150 29.7	04.9	344 00.2	54.4
21	190 12.8	159 28.5	. . 47.6	157 21.7	. . 37.8	165 31.6	. . 05.1	359 02.8	. . 54.4
22	205 15.3	174 28.1	48.7	172 22.3	38.5	180 33.5	05.3	14 05.4	54.3
23	220 17.7	189 27.7	49.8	187 23.0	39.1	195 35.5	05.5	29 07.9	54.3
18 00	235 20.2	204 27.3	N10 50.8	202 23.7	N12 39.8	210 37.4	N 9 05.7	44 10.5	S 1 54.3
01	250 22.7	219 26.8	51.9	217 24.3	40.4	225 39.3	05.9	59 13.1	54.2
02	265 25.1	234 26.4	53.0	232 25.0	41.1	240 41.3	06.1	74 15.6	54.2
03	280 27.6	249 26.0	. . 54.0	247 25.7	. . 41.7	255 43.2	. . 06.3	89 18.2	. . 54.2
04	295 30.1	264 25.6	55.1	262 26.3	42.4	270 45.1	06.5	104 20.7	54.1
05	310 32.5	279 25.1	56.2	277 27.0	43.0	285 47.1	06.7	119 23.3	54.1
06	325 35.0	294 24.7	N10 57.2	292 27.7	N12 43.7	300 49.0	N 9 06.9	134 25.9	S 1 54.1
W 07	340 37.4	309 24.3	58.3	307 28.3	44.3	315 50.9	07.1	149 28.4	54.0
E 08	355 39.9	324 23.8	10 59.4	322 29.0	45.0	330 52.9	07.3	164 31.0	54.0
D 09	10 42.4	339 23.4	11 00.4	337 29.7	. . 45.6	345 54.8	. . 07.5	179 33.6	. . 54.0
N 10	25 44.8	354 23.0	01.5	352 30.3	46.2	0 56.7	07.7	194 36.1	53.9
E 11	40 47.3	9 22.5	02.6	7 31.0	46.9	15 58.7	07.9	209 38.7	53.9
S 12	55 49.8	24 22.1	N11 03.6	22 31.7	N12 47.5	31 00.6	N 9 08.1	224 41.2	S 1 53.9
D 13	70 52.2	39 21.7	04.7	37 32.3	48.2	46 02.6	08.3	239 43.8	53.8
A 14	85 54.7	54 21.2	05.7	52 33.0	48.8	61 04.5	08.5	254 46.4	53.8
Y 15	100 57.2	69 20.8	. . 06.8	67 33.7	. . 49.5	76 06.4	. . 08.7	269 48.9	. . 53.8
16	115 59.6	84 20.4	07.9	82 34.3	50.1	91 08.4	08.9	284 51.5	53.7
17	131 02.1	99 19.9	08.9	97 35.0	50.7	106 10.3	09.1	299 54.1	53.7
18	146 04.6	114 19.5	N11 10.0	112 35.7	N12 51.4	121 12.2	N 9 09.3	314 56.6	S 1 53.7
19	161 07.0	129 19.1	11.1	127 36.3	52.0	136 14.2	09.5	329 59.2	53.6
20	176 09.5	144 18.6	12.1	142 37.0	52.7	151 16.1	09.7	345 01.7	53.6
21	191 11.9	159 18.2	. . 13.2	157 37.7	. . 53.3	166 18.0	. . 09.9	0 04.3	. . 53.6
22	206 14.4	174 17.8	14.2	172 38.3	54.0	181 20.0	10.1	15 06.9	53.5
23	221 16.9	189 17.3	15.3	187 39.0	54.6	196 21.9	10.3	30 09.4	53.5
	h m								
Mer. Pass.	8 21.2	*v* −0.4	*d* 1.1	*v* 0.7	*d* 0.6	*v* 1.9	*d* 0.2	*v* 2.6	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.5
Achernar	335 28.3	S57 10.6
Acrux	173 10.6	S63 10.1
Adhara	255 14.0	S28 59.5
Aldebaran	290 51.4	N16 31.8
Alioth	166 21.5	N55 53.9
Alkaid	152 59.6	N49 15.4
Al Na'ir	27 45.6	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.5
Alpheratz	357 45.3	N29 09.1
Altair	62 09.5	N 8 53.9
Ankaa	353 17.4	S42 14.4
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.3
Atria	107 30.4	S69 02.8
Avior	234 18.9	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.3	S52 42.4
Capella	280 37.1	N46 00.5
Deneb	49 32.4	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.6	S17 55.4
Dubhe	193 53.2	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.4	N51 29.1
Enif	33 48.6	N 9 55.6
Fomalhaut	15 25.7	S29 33.5
Gacrux	172 02.3	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.5	S60 25.9
Hamal	328 02.8	N23 30.9
Kaus Aust.	83 45.5	S34 22.6
Kochab	137 18.6	N74 06.5
Markab	13 39.9	N15 15.9
Menkar	314 16.9	N 4 08.0
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.3	S69 46.3
Mirfak	308 43.0	N49 54.0
Nunki	75 59.9	S26 16.8
Peacock	53 21.3	S56 41.6
Pollux	243 29.7	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.5	N12 33.0
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.1
Sabik	102 13.9	S15 44.3
Schedar	349 42.7	N56 35.8
Shaula	96 23.6	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.7	S43 29.1
Vega	80 39.7	N38 47.5
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	330 16.4	10 22
Mars	327 46.6	10 31
Jupiter	335 29.9	9 59
Saturn	168 47.9	21 04

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
16 00	180 54.6	N18 58.1	22 23.2	6.3	S16 46.1	10.5	60.5
01	195 54.6	58.7	36 48.5	6.2	16 56.6	10.4	60.5
02	210 54.6	59.3	51 13.7	6.2	17 07.0	10.3	60.5
03	225 54.6	18 59.9	65 38.9	6.1	17 17.3	10.2	60.5
04	240 54.6	19 00.5	80 04.0	6.0	17 27.5	10.1	60.5
05	255 54.5	01.1	94 29.0	6.0	17 37.6	9.9	60.5
06	270 54.5	N19 01.6	108 54.0	5.9	S17 47.5	9.8	60.5
07	285 54.5	02.2	123 18.9	5.8	17 57.3	9.7	60.5
08	300 54.5	02.8	137 43.7	5.8	18 07.0	9.6	60.5
M 09	315 54.5	03.4	152 08.5	5.8	18 16.6	9.5	60.4
O 10	330 54.5	04.0	166 33.3	5.6	18 26.1	9.3	60.4
N 11	345 54.5	04.5	180 57.9	5.7	18 35.4	9.2	60.4
D 12	0 54.5	N19 05.1	195 22.6	5.5	S18 44.6	9.0	60.4
A 13	15 54.5	05.7	209 47.1	5.5	18 53.6	9.0	60.4
Y 14	30 54.5	06.3	224 11.6	5.5	19 02.6	8.8	60.4
15	45 54.4	06.8	238 36.1	5.4	19 11.4	8.6	60.4
16	60 54.4	07.4	253 00.5	5.4	19 20.0	8.6	60.4
17	75 54.4	08.0	267 24.9	5.3	19 28.6	8.3	60.4
18	90 54.4	N19 08.6	281 49.2	5.2	S19 36.9	8.3	60.3
19	105 54.4	09.1	296 13.4	5.2	19 45.2	8.1	60.3
20	120 54.4	09.7	310 37.6	5.2	19 53.3	8.0	60.3
21	135 54.4	10.3	325 01.8	5.1	20 01.3	7.8	60.3
22	150 54.4	10.9	339 25.9	5.0	20 09.1	7.7	60.3
23	165 54.3	11.4	353 49.9	5.1	20 16.8	7.6	60.3
17 00	180 54.3	N19 12.0	8 14.0	4.9	S20 24.4	7.4	60.3
01	195 54.3	12.6	22 37.9	5.0	20 31.8	7.2	60.2
02	210 54.3	13.1	37 01.9	4.9	20 39.0	7.1	60.2
03	225 54.3	13.7	51 25.8	4.8	20 46.1	7.0	60.2
04	240 54.3	14.3	65 49.6	4.9	20 53.1	6.8	60.2
05	255 54.3	14.8	80 13.5	4.8	20 59.9	6.7	60.2
06	270 54.2	N19 15.4	94 37.3	4.7	S21 06.6	6.5	60.1
07	285 54.2	16.0	109 01.0	4.7	21 13.1	6.3	60.1
T 08	300 54.2	16.5	123 24.7	4.7	21 19.4	6.2	60.1
U 09	315 54.2	17.1	137 48.4	4.7	21 25.6	6.1	60.1
E 10	330 54.2	17.7	152 12.1	4.6	21 31.7	5.9	60.1
S 11	345 54.2	18.2	166 35.7	4.6	21 37.6	5.8	60.1
D 12	0 54.1	N19 18.8	180 59.3	4.6	S21 43.4	5.5	60.0
A 13	15 54.1	19.4	195 22.9	4.6	21 48.9	5.5	60.0
Y 14	30 54.1	19.9	209 46.5	4.5	21 54.4	5.3	60.0
15	45 54.1	20.5	224 10.0	4.6	21 59.7	5.1	60.0
16	60 54.1	21.1	238 33.6	4.5	22 04.8	4.9	59.9
17	75 54.1	21.6	252 57.1	4.5	22 09.7	4.9	59.9
18	90 54.0	N19 22.2	267 20.6	4.5	S22 14.6	4.6	59.9
19	105 54.0	22.7	281 44.1	4.4	22 19.2	4.5	59.9
20	120 54.0	23.3	296 07.5	4.5	22 23.7	4.3	59.9
21	135 54.0	23.9	310 31.0	4.4	22 28.0	4.2	59.8
22	150 54.0	24.4	324 54.4	4.5	22 32.2	4.0	59.8
23	165 53.9	25.0	339 17.9	4.4	22 36.2	3.8	59.8
18 00	180 53.9	N19 25.5	353 41.3	4.5	S22 40.0	3.7	59.8
01	195 53.9	26.1	8 04.8	4.4	22 43.7	3.6	59.7
02	210 53.9	26.6	22 28.2	4.5	22 47.3	3.3	59.7
03	225 53.9	27.2	36 51.7	4.4	22 50.6	3.2	59.7
04	240 53.8	27.8	51 15.1	4.5	22 53.8	3.1	59.6
05	255 53.8	28.3	65 38.6	4.4	22 56.9	2.8	59.6
06	270 53.8	N19 28.9	80 02.0	4.5	S22 59.7	2.8	59.6
W 07	285 53.8	29.4	94 25.5	4.5	23 02.5	2.5	59.6
E 08	300 53.8	30.0	108 49.0	4.5	23 05.0	2.4	59.5
D 09	315 53.7	30.5	123 12.5	4.5	23 07.4	2.2	59.5
N 10	330 53.7	31.1	137 36.0	4.5	23 09.6	2.1	59.5
E 11	345 53.7	31.6	151 59.5	4.6	23 11.7	1.9	59.5
S 12	0 53.7	N19 32.2	166 23.1	4.5	S23 13.6	1.8	59.4
D 13	15 53.6	32.7	180 46.6	4.6	23 15.4	1.5	59.4
A 14	30 53.6	33.3	195 10.2	4.7	23 16.9	1.5	59.4
Y 15	45 53.6	33.8	209 33.9	4.6	23 18.4	1.2	59.3
16	60 53.6	34.4	223 57.5	4.7	23 19.6	1.1	59.3
17	75 53.5	34.9	238 21.2	4.7	23 20.7	1.0	59.3
18	90 53.5	N19 35.5	252 44.9	4.7	S23 21.7	0.8	59.2
19	105 53.5	36.0	267 08.6	4.8	23 22.5	0.6	59.2
20	120 53.5	36.6	281 32.4	4.8	23 23.1	0.4	59.2
21	135 53.4	37.1	295 56.2	4.9	23 23.5	0.3	59.1
22	150 53.4	37.6	310 20.1	4.9	23 23.8	0.2	59.1
23	165 53.4	38.2	324 44.0	4.9	S23 24.0	0.0	59.1
	SD 15.8	d 0.6	SD 16.5		16.4		16.2

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 16	Moonrise 17	Moonrise 18	Moonrise 19
	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70							
68	////	////	01 38	21 47			
66	////	////	02 16	21 03	23 05	24 38	00 38
64	////	00 56	02 42	20 34	22 18	23 36	24 18
62	////	01 44	03 02	20 12	21 47	23 01	23 48
60	////	02 14	03 19	19 54	21 24	22 36	23 26
N 58	00 50	02 36	03 32	19 39	21 06	22 16	23 08
56	01 34	02 54	03 44	19 27	20 50	22 00	22 52
54	02 02	03 09	03 55	19 16	20 37	21 46	22 39
52	02 22	03 21	04 04	19 06	20 25	21 33	22 27
50	02 39	03 32	04 12	18 58	20 15	21 22	22 17
45	03 11	03 55	04 29	18 39	19 54	21 00	21 55
N 40	03 35	04 13	04 43	18 24	19 36	20 42	21 38
35	03 53	04 27	04 55	18 12	19 22	20 26	21 23
30	04 08	04 39	05 06	18 01	19 09	20 13	21 10
20	04 32	05 00	05 23	17 43	18 48	19 50	20 49
N 10	04 50	05 16	05 39	17 26	18 29	19 31	20 30
0	05 05	05 31	05 53	17 11	18 12	19 13	20 12
S 10	05 19	05 45	06 07	16 57	17 55	18 54	19 54
20	05 32	05 59	06 22	16 41	17 36	18 35	19 35
30	05 44	06 13	06 39	16 23	17 15	18 13	19 13
35	05 51	06 22	06 49	16 12	17 03	17 59	19 00
40	05 58	06 31	07 00	16 00	16 49	17 44	18 46
45	06 05	06 41	07 13	15 46	16 32	17 26	18 28
S 50	06 13	06 53	07 29	15 30	16 12	17 04	18 06
52	06 17	06 58	07 36	15 22	16 02	16 53	17 56
54	06 21	07 04	07 45	15 13	15 51	16 41	17 44
56	06 25	07 11	07 54	15 03	15 39	16 28	17 31
58	06 29	07 18	08 05	14 52	15 25	16 12	17 15
S 60	06 34	07 27	08 17	14 39	15 08	15 53	16 56

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 16	Moonset 17	Moonset 18	Moonset 19
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70				00 42			
68	22 20	////	////	01 14	00 53		
66	21 40	////	////	01 38	01 37	01 42	02 17
64	21 13	23 06	////	01 56	02 07	02 30	03 19
62	20 53	22 12	////	02 12	02 30	03 01	03 53
60	20 36	21 42	////	02 25	02 48	03 24	04 18
N 58	20 22	21 19	23 11	02 36	03 03	03 43	04 38
56	20 10	21 01	22 22	02 46	03 16	03 58	04 54
54	19 59	20 46	21 54	02 55	03 28	04 12	05 09
52	19 50	20 33	21 32	03 02	03 38	04 24	05 21
50	19 42	20 22	21 15	03 09	03 47	04 34	05 32
45	19 24	19 59	20 43	03 24	04 06	04 56	05 54
N 40	19 10	19 41	20 19	03 37	04 22	05 14	06 13
35	18 58	19 26	20 01	03 48	04 35	05 29	06 28
30	18 47	19 14	19 45	03 57	04 47	05 42	06 41
20	18 30	18 53	19 21	04 13	05 06	06 04	07 04
N 10	18 14	18 37	19 03	04 27	05 24	06 23	07 23
0	18 00	18 22	18 47	04 41	05 40	06 41	07 41
S 10	17 46	18 08	18 34	04 54	05 56	06 59	07 59
20	17 31	17 54	18 21	05 08	06 14	07 18	08 19
30	17 14	17 39	18 08	05 25	06 34	07 40	08 41
35	17 04	17 31	18 02	05 34	06 45	07 53	08 54
40	16 53	17 22	17 55	05 45	06 59	08 08	09 09
45	16 39	17 11	17 47	05 58	07 15	08 26	09 27
S 50	16 23	16 59	17 39	06 14	07 35	08 48	09 49
52	16 16	16 54	17 35	06 21	07 44	08 58	10 00
54	16 08	16 48	17 31	06 30	07 55	09 10	10 11
56	15 58	16 41	17 27	06 39	08 07	09 24	10 25
58	15 48	16 34	17 23	06 50	08 21	09 40	10 41
S 60	15 35	16 25	17 18	07 02	08 37	09 59	11 00

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	%
16	03 38	03 38	11 56	23 26	10 56	13	99
17	03 37	03 37	11 56	24 26	11 56	14	100
18	03 36	03 35	11 56	00 26	12 57	15	99

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
19 00	236 19.3	204 16.9	N11 16.3	202 39.7	N12 55.2	211 23.8	N 9 10.5	45 12.0	S 1 53.5
01	251 21.8	219 16.5	17.4	217 40.3	55.9	226 25.8	10.7	60 14.5	53.5
02	266 24.3	234 16.0	18.5	232 41.0	56.5	241 27.7	10.9	75 17.1	53.4
03	281 26.7	249 15.6	19.5	247 41.7	57.2	256 29.7	11.1	90 19.7	53.4
04	296 29.2	264 15.2	20.6	262 42.3	57.8	271 31.6	11.3	105 22.2	53.4
05	311 31.7	279 14.7	21.6	277 43.0	58.4	286 33.5	11.5	120 24.8	53.3
06	326 34.1	294 14.3	N11 22.7	292 43.7	N12 59.1	301 35.5	N 9 11.7	135 27.3	S 1 53.3
07	341 36.6	309 13.8	23.7	307 44.3	12 59.7	316 37.4	11.9	150 29.9	53.3
T 08	356 39.1	324 13.4	24.8	322 45.0	13 00.4	331 39.3	12.1	165 32.5	53.2
H 09	11 41.5	339 13.0	25.9	337 45.7	01.0	346 41.3	12.3	180 35.0	53.2
U 10	26 44.0	354 12.5	26.9	352 46.3	01.6	1 43.2	12.5	195 37.6	53.2
R 11	41 46.4	9 12.1	28.0	7 47.0	02.3	16 45.2	12.7	210 40.1	53.1
S 12	56 48.9	24 11.6	N11 29.0	22 47.7	N13 02.9	31 47.1	N 9 12.9	225 42.7	S 1 53.1
D 13	71 51.4	39 11.2	30.1	37 48.3	03.6	46 49.0	13.1	240 45.3	53.1
A 14	86 53.8	54 10.8	31.1	52 49.0	04.2	61 51.0	13.3	255 47.8	53.0
Y 15	101 56.3	69 10.3	32.2	67 49.7	04.8	76 52.9	13.5	270 50.4	53.0
16	116 58.8	84 09.9	33.2	82 50.3	05.5	91 54.8	13.7	285 52.9	53.0
17	132 01.2	99 09.4	34.3	97 51.0	06.1	106 56.8	13.9	300 55.5	53.0
18	147 03.7	114 09.0	N11 35.3	112 51.6	N13 06.7	121 58.7	N 9 14.1	315 58.1	S 1 52.9
19	162 06.2	129 08.6	36.4	127 52.3	07.4	137 00.7	14.3	331 00.6	52.9
20	177 08.6	144 08.1	37.4	142 53.0	08.0	152 02.6	14.5	346 03.2	52.9
21	192 11.1	159 07.7	38.5	157 53.6	08.6	167 04.5	14.7	1 05.7	52.8
22	207 13.6	174 07.2	39.5	172 54.3	09.3	182 06.5	14.9	16 08.3	52.8
23	222 16.0	189 06.8	40.6	187 55.0	09.9	197 08.4	15.1	31 10.8	52.8
20 00	237 18.5	204 06.3	N11 41.6	202 55.6	N13 10.6	212 10.3	N 9 15.3	46 13.4	S 1 52.7
01	252 20.9	219 05.9	42.7	217 56.3	11.2	227 12.3	15.5	61 16.0	52.7
02	267 23.4	234 05.4	43.7	232 57.0	11.8	242 14.2	15.7	76 18.5	52.7
03	282 25.9	249 05.0	44.8	247 57.6	12.5	257 16.2	15.9	91 21.1	52.6
04	297 28.3	264 04.6	45.8	262 58.3	13.1	272 18.1	16.1	106 23.6	52.6
05	312 30.8	279 04.1	46.8	277 59.0	13.7	287 20.0	16.3	121 26.2	52.6
06	327 33.3	294 03.7	N11 47.9	292 59.6	N13 14.4	302 22.0	N 9 16.5	136 28.7	S 1 52.6
07	342 35.7	309 03.2	48.9	308 00.3	15.0	317 23.9	16.6	151 31.3	52.5
08	357 38.2	324 02.8	50.0	323 00.9	15.6	332 25.9	16.8	166 33.9	52.5
F 09	12 40.7	339 02.3	51.0	338 01.6	16.3	347 27.8	17.0	181 36.4	52.5
R 10	27 43.1	354 01.9	52.1	353 02.3	16.9	2 29.7	17.2	196 39.0	52.4
I 11	42 45.6	9 01.4	53.1	8 02.9	17.5	17 31.7	17.4	211 41.5	52.4
D 12	57 48.1	24 01.0	N11 54.2	23 03.6	N13 18.2	32 33.6	N 9 17.6	226 44.1	S 1 52.4
A 13	72 50.5	39 00.5	55.2	38 04.3	18.8	47 35.5	17.8	241 46.6	52.3
Y 14	87 53.0	54 00.1	56.2	53 04.9	19.4	62 37.5	18.0	256 49.2	52.3
15	102 55.4	68 59.6	57.3	68 05.6	20.1	77 39.4	18.2	271 51.7	52.3
16	117 57.9	83 59.2	58.3	83 06.2	20.7	92 41.4	18.4	286 54.3	52.3
17	133 00.4	98 58.7	11 59.4	98 06.9	21.3	107 43.3	18.6	301 56.9	52.2
18	148 02.8	113 58.3	N12 00.4	113 07.6	N13 21.9	122 45.2	N 9 18.8	316 59.4	S 1 52.2
19	163 05.3	128 57.8	01.4	128 08.2	22.6	137 47.2	19.0	332 02.0	52.2
20	178 07.8	143 57.4	02.5	143 08.9	23.2	152 49.1	19.2	347 04.5	52.1
21	193 10.2	158 56.9	03.5	158 09.6	23.8	167 51.1	19.4	2 07.1	52.1
22	208 12.7	173 56.5	04.6	173 10.2	24.5	182 53.0	19.6	17 09.6	52.1
23	223 15.2	188 56.0	05.6	188 10.9	25.1	197 54.9	19.8	32 12.2	52.1
21 00	238 17.6	203 55.6	N12 06.6	203 11.5	N13 25.7	212 56.9	N 9 20.0	47 14.7	S 1 52.0
01	253 20.1	218 55.1	07.7	218 12.2	26.4	227 58.8	20.2	62 17.3	52.0
02	268 22.6	233 54.6	08.7	233 12.9	27.0	243 00.8	20.4	77 19.8	52.0
03	283 25.0	248 54.2	09.7	248 13.5	27.6	258 02.7	20.6	92 22.4	51.9
04	298 27.5	263 53.7	10.8	263 14.2	28.2	273 04.6	20.8	107 24.9	51.9
05	313 29.9	278 53.3	11.8	278 14.9	28.9	288 06.6	21.0	122 27.5	51.9
06	328 32.4	293 52.8	N12 12.8	293 15.5	N13 29.5	303 08.5	N 9 21.2	137 30.1	S 1 51.9
07	343 34.9	308 52.4	13.9	308 16.2	30.1	318 10.5	21.4	152 32.6	51.8
S 08	358 37.3	323 51.9	14.9	323 16.8	30.8	333 12.4	21.6	167 35.2	51.8
A 09	13 39.8	338 51.5	15.9	338 17.5	31.4	348 14.3	21.7	182 37.7	51.8
T 10	28 42.3	353 51.0	17.0	353 18.2	32.0	3 16.3	21.9	197 40.3	51.7
U 11	43 44.7	8 50.5	18.0	8 18.8	32.6	18 18.2	22.1	212 42.8	51.7
R 12	58 47.2	23 50.1	N12 19.0	23 19.5	N13 33.3	33 20.2	N 9 22.3	227 45.4	S 1 51.7
D 13	73 49.7	38 49.6	20.1	38 20.2	33.9	48 22.1	22.5	242 47.9	51.7
A 14	88 52.1	53 49.2	21.1	53 20.8	34.5	63 24.0	22.7	257 50.5	51.6
Y 15	103 54.6	68 48.7	22.1	68 21.5	35.1	78 26.0	22.9	272 53.0	51.6
16	118 57.0	83 48.2	23.2	83 22.1	35.8	93 27.9	23.1	287 55.6	51.6
17	133 59.5	98 47.8	24.2	98 22.8	36.4	108 29.9	23.3	302 58.1	51.5
18	149 02.0	113 47.3	N12 25.2	113 23.5	N13 37.0	123 31.8	N 9 23.5	318 00.7	S 1 51.5
19	164 04.4	128 46.9	26.2	128 24.1	37.6	138 33.8	23.7	333 03.2	51.5
20	179 06.9	143 46.4	27.3	143 24.8	38.3	153 35.7	23.9	348 05.8	51.5
21	194 09.4	158 45.9	28.3	158 25.4	38.9	168 37.6	24.1	3 08.3	51.4
22	209 11.8	173 45.5	29.3	173 26.1	39.5	183 39.6	24.3	18 10.9	51.4
23	224 14.3	188 45.0	30.3	188 26.8	40.1	198 41.5	24.5	33 13.4	51.4
	h m								
Mer. Pass.	8 09.4	v −0.4	d 1.0	v 0.7	d 0.6	v 1.9	d 0.2	v 2.6	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.9	S40 15.5
Achernar	335 28.3	S57 10.5
Acrux	173 10.6	S63 10.1
Adhara	255 14.0	S28 59.5
Aldebaran	290 51.4	N16 31.8
Alioth	166 21.5	N55 54.0
Alkaid	152 59.6	N49 15.4
Al Na'ir	27 45.5	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.5
Alpheratz	357 45.3	N29 09.1
Altair	62 09.5	N 8 53.9
Ankaa	353 17.4	S42 14.4
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.3
Atria	107 30.4	S69 02.8
Avior	234 19.0	S59 33.2
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.3	S52 42.4
Capella	280 37.1	N46 00.5
Deneb	49 32.4	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.6	S17 55.3
Dubhe	193 53.2	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.4	N51 29.1
Enif	33 48.6	N 9 55.6
Fomalhaut	15 25.7	S29 33.5
Gacrux	172 02.3	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.5	S60 25.9
Hamal	328 02.8	N23 30.9
Kaus Aust.	83 45.4	S34 22.6
Kochab	137 18.7	N74 06.5
Markab	13 39.9	N15 16.0
Menkar	314 16.9	N 4 08.0
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.3	S69 46.3
Mirfak	308 43.0	N49 54.0
Nunki	75 59.9	S26 16.8
Peacock	53 21.3	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.5	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.1
Sabik	102 13.9	S15 44.3
Schedar	349 42.7	N56 35.8
Shaula	96 23.6	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.7	S43 29.1
Vega	80 39.6	N38 47.5
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	326 47.9	10 24
Mars	325 37.1	10 28
Jupiter	334 51.9	9 50
Saturn	168 54.9	20 52

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
19 00	180 53.4	N19 38.7	339 07.9	5.0	S23 24.0	0.2	59.1
01	195 53.3	39.3	353 31.9	5.0	23 23.8	0.3	59.0
02	210 53.3	39.8	7 55.9	5.1	23 23.5	0.5	59.0
03	225 53.3	. . 40.4	22 20.0	5.1	23 23.0	0.6	59.0
04	240 53.3	40.9	36 44.1	5.2	23 22.4	0.8	58.9
05	255 53.2	41.4	51 08.3	5.3	23 21.6	1.0	58.9
06	270 53.2	N19 42.0	65 32.6	5.2	S23 20.6	1.1	58.9
07	285 53.2	42.5	79 56.8	5.4	23 19.5	1.2	58.8
08	300 53.2	43.1	94 21.2	5.4	23 18.3	1.4	58.8
09	315 53.1	. . 43.6	108 45.6	5.5	23 16.9	1.6	58.8
10	330 53.1	44.1	123 10.1	5.5	23 15.3	1.7	58.7
11	345 53.1	44.7	137 34.6	5.6	23 13.6	1.9	58.7
12	0 53.0	N19 45.2	151 59.2	5.6	S23 11.7	2.0	58.7
13	15 53.0	45.7	166 23.8	5.8	23 09.7	2.1	58.6
14	30 53.0	46.3	180 48.6	5.7	23 07.6	2.3	58.6
15	45 53.0	. . 46.8	195 13.3	5.9	23 05.3	2.5	58.5
16	60 52.9	47.4	209 38.2	5.9	23 02.8	2.5	58.5
17	75 52.9	47.9	224 03.1	6.0	23 00.3	2.8	58.5
18	90 52.9	N19 48.4	238 28.1	6.1	S22 57.5	2.9	58.4
19	105 52.8	49.0	252 53.2	6.1	22 54.6	3.0	58.4
20	120 52.8	49.5	267 18.3	6.3	22 51.6	3.1	58.4
21	135 52.8	. . 50.0	281 43.6	6.3	22 48.5	3.3	58.3
22	150 52.7	50.5	296 08.9	6.4	22 45.2	3.5	58.3
23	165 52.7	51.1	310 34.3	6.4	22 41.7	3.5	58.3
20 00	180 52.7	N19 51.6	324 59.7	6.6	S22 38.2	3.8	58.2
01	195 52.7	52.1	339 25.3	6.6	22 34.4	3.8	58.2
02	210 52.6	52.7	353 50.9	6.7	22 30.6	4.0	58.2
03	225 52.6	. . 53.2	8 16.6	6.8	22 26.6	4.1	58.1
04	240 52.6	53.7	22 42.4	6.8	22 22.5	4.2	58.1
05	255 52.5	54.2	37 08.2	7.0	22 18.3	4.4	58.1
06	270 52.5	N19 54.8	51 34.2	7.1	S22 13.9	4.5	58.0
07	285 52.5	55.3	66 00.3	7.1	22 09.4	4.7	58.0
08	300 52.4	55.8	80 26.4	7.2	22 04.7	4.7	57.9
09	315 52.4	. . 56.3	94 52.6	7.3	22 00.0	4.9	57.9
10	330 52.4	56.9	109 18.9	7.4	21 55.1	5.0	57.9
11	345 52.3	57.4	123 45.3	7.5	21 50.1	5.2	57.8
12	0 52.3	N19 57.9	138 11.8	7.6	S21 44.9	5.2	57.8
13	15 52.3	58.4	152 38.4	7.7	21 39.7	5.4	57.8
14	30 52.2	59.0	167 05.1	7.7	21 34.3	5.5	57.7
15	45 52.2	19 59.5	181 31.8	7.9	21 28.8	5.6	57.7
16	60 52.2	20 00.0	195 58.7	8.0	21 23.2	5.8	57.7
17	75 52.1	00.5	210 25.7	8.0	21 17.4	5.8	57.6
18	90 52.1	N20 01.0	224 52.7	8.2	S21 11.6	6.0	57.6
19	105 52.0	01.6	239 19.9	8.2	21 05.6	6.1	57.5
20	120 52.0	02.1	253 47.1	8.3	20 59.5	6.2	57.5
21	135 52.0	. . 02.6	268 14.4	8.5	20 53.3	6.3	57.5
22	150 51.9	03.1	282 41.9	8.5	20 47.0	6.4	57.4
23	165 51.9	03.6	297 09.4	8.6	20 40.6	6.5	57.4
21 00	180 51.9	N20 04.1	311 37.0	8.7	S20 34.1	6.7	57.4
01	195 51.8	04.7	326 04.7	8.9	20 27.4	6.7	57.3
02	210 51.8	05.2	340 32.6	8.9	20 20.7	6.8	57.3
03	225 51.7	. . 05.7	355 00.5	9.0	20 13.9	7.0	57.3
04	240 51.7	06.2	9 28.5	9.1	20 06.9	7.0	57.2
05	255 51.7	06.7	23 56.6	9.2	19 59.9	7.2	57.2
06	270 51.6	N20 07.2	38 24.8	9.3	S19 52.7	7.2	57.1
07	285 51.6	07.7	52 53.1	9.4	19 45.5	7.4	57.1
08	300 51.6	08.2	67 21.5	9.5	19 38.1	7.4	57.1
09	315 51.5	. . 08.8	81 50.0	9.6	19 30.7	7.6	57.0
10	330 51.5	09.3	96 18.6	9.7	19 23.1	7.6	57.0
11	345 51.4	09.8	110 47.3	9.8	19 15.5	7.7	57.0
12	0 51.4	N20 10.3	125 16.1	9.9	S19 07.8	7.8	56.9
13	15 51.4	10.8	139 45.0	10.0	19 00.0	7.9	56.9
14	30 51.3	11.3	154 14.0	10.0	18 52.1	8.0	56.9
15	45 51.3	. . 11.8	168 43.0	10.2	18 44.1	8.1	56.8
16	60 51.2	12.3	183 12.2	10.3	18 36.0	8.2	56.8
17	75 51.2	12.8	197 41.5	10.4	18 27.8	8.2	56.8
18	90 51.2	N20 13.3	212 10.9	10.4	S18 19.6	8.4	56.7
19	105 51.1	13.8	226 40.3	10.6	18 11.2	8.4	56.7
20	120 51.1	14.3	241 09.9	10.7	18 02.8	8.5	56.6
21	135 51.0	. . 14.8	255 39.6	10.7	17 54.3	8.6	56.6
22	150 51.0	15.3	270 09.3	10.9	17 45.7	8.6	56.6
23	165 50.9	15.8	284 39.2	10.9	S17 37.1	8.8	56.5
	SD 15.8	d 0.5	SD	16.0		15.7	15.5

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 19	Moonrise 20	Moonrise 21	Moonrise 22
°	h m	h m	h m	h m	h m	h m	h m
N 72							02 56
N 70							02 03
68	////	////	01 19				01 48
66	////	////	02 04	00 38	01 03	01 06	01 29
64	////	00 21	02 33	24 18	00 18	00 37	01 05
62	////	01 31	02 55	23 48	24 15	00 15	00 46
60	////	02 04	03 12	23 26	23 57	24 17	00 30
N 58	00 19	02 28	03 27	23 08	23 42	24 06	00 17
56	01 22	02 47	03 39	22 52	23 29	23 56	00 06
54	01 53	03 03	03 50	22 39	23 18	23 47	24 15
52	02 15	03 16	04 00	22 27	23 08	23 39	24 09
50	02 33	03 28	04 08	22 17	22 59	23 32	24 03
45	03 07	03 51	04 26	21 55	22 40	23 17	23 58
N 40	03 31	04 10	04 41	21 38	22 25	23 04	23 46
35	03 50	04 25	04 53	21 23	22 12	22 53	23 37
30	04 06	04 38	05 04	21 10	22 01	22 44	23 29
20	04 30	04 59	05 22	20 49	21 41	22 28	23 22
N 10	04 49	05 16	05 38	20 30	21 24	22 13	23 09
0	05 05	05 31	05 53	20 12	21 08	22 00	22 58
S 10	05 20	05 45	06 08	19 54	20 52	21 46	22 48
20	05 33	06 00	06 23	19 35	20 35	21 32	22 38
30	05 46	06 15	06 41	19 13	20 15	21 16	22 27
35	05 53	06 24	06 51	19 00	20 03	21 06	22 14
40	06 00	06 33	07 02	18 46	19 50	20 55	22 07
45	06 08	06 44	07 16	18 28	19 34	20 42	21 58
S 50	06 17	06 57	07 33	18 06	19 15	20 26	21 48
52	06 21	07 02	07 41	17 56	19 06	20 19	21 37
54	06 25	07 09	07 49	17 44	18 55	20 10	21 31
56	06 29	07 16	07 59	17 31	18 44	20 01	21 25
58	06 34	07 23	08 10	17 15	18 30	19 50	21 18
S 60	06 39	07 32	08 23	16 56	18 14	19 38	21 10

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 19	Moonset 20	Moonset 21	Moonset 22
°	h m	h m	h m	h m	h m	h m	h m
N 72							05 44
N 70							06 37
68	22 40	////	////			05 04	07 09
66	21 53	////	////	02 17	03 54	05 46	07 32
64	21 23	////	////	03 19	04 39	06 14	07 50
62	21 00	22 26	////	03 53	05 08	06 36	08 05
60	20 43	21 51	////	04 18	05 30	06 53	08 18
N 58	20 28	21 27	////	04 38	05 48	07 07	08 28
56	20 15	21 07	22 35	04 54	06 03	07 20	08 38
54	20 04	20 51	22 03	05 09	06 16	07 30	08 46
52	19 54	20 38	21 40	05 21	06 28	07 40	08 53
50	19 46	20 26	21 21	05 32	06 38	07 48	09 00
45	19 27	20 02	20 47	05 54	06 59	08 06	09 14
N 40	19 13	19 44	20 23	06 13	07 16	08 21	09 26
35	19 00	19 29	20 03	06 28	07 30	08 33	09 35
30	18 49	19 16	19 48	06 41	07 43	08 44	09 44
20	18 31	18 55	19 23	07 04	08 04	09 03	09 59
N 10	18 15	18 37	19 04	07 23	08 22	09 18	10 11
0	18 00	18 22	18 48	07 41	08 39	09 33	10 23
S 10	17 45	18 08	18 33	07 59	08 56	09 48	10 35
20	17 30	17 53	18 20	08 19	09 14	10 04	10 48
30	17 12	17 38	18 07	08 41	09 35	10 22	11 02
35	17 02	17 29	18 00	08 54	09 47	10 32	11 10
40	16 50	17 20	17 53	09 09	10 01	10 44	11 20
45	16 36	17 09	17 45	09 27	10 17	10 58	11 31
S 50	16 20	16 56	17 36	09 49	10 37	11 15	11 44
52	16 12	16 50	17 32	10 00	10 47	11 23	11 50
54	16 03	16 44	17 28	10 11	10 58	11 31	11 57
56	15 53	16 37	17 23	10 25	11 10	11 41	12 04
58	15 42	16 29	17 18	10 41	11 24	11 52	12 12
S 60	15 29	16 20	17 13	11 00	11 40	12 05	12 22

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
19	03 34	03 32	11 56	01 27	13 57	16	95
20	03 31	03 29	11 57	02 26	14 54	17	88
21	03 28	03 26	11 57	03 21	15 47	18	81

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
22 00	239 16.8	203 44.6	N12 31.4	203 27.4	N13 40.8	213 43.5	N 9 24.7	48 16.0	S 1 51.4
01	254 19.2	218 44.1	32.4	218 28.1	41.4	228 45.4	24.9	63 18.5	51.3
02	269 21.7	233 43.6	33.4	233 28.7	42.0	243 47.3	25.1	78 21.1	51.3
03	284 24.2	248 43.2	34.4	248 29.4	42.6	258 49.3	25.3	93 23.6	51.3
04	299 26.6	263 42.7	35.5	263 30.1	43.3	273 51.2	25.5	108 26.2	51.2
05	314 29.1	278 42.2	36.5	278 30.7	43.9	288 53.2	25.6	123 28.7	51.2
06	329 31.5	293 41.8	N12 37.5	293 31.4	N13 44.5	303 55.1	N 9 25.8	138 31.3	S 1 51.2
07	344 34.0	308 41.3	38.5	308 32.0	45.1	318 57.1	26.0	153 33.8	51.2
08	359 36.5	323 40.8	39.6	323 32.7	45.7	333 59.0	26.2	168 36.4	51.1
S 09	14 38.9	338 40.4	40.6	338 33.4	46.4	349 00.9	26.4	183 38.9	51.1
U 10	29 41.4	353 39.9	41.6	353 34.0	47.0	4 02.9	26.6	198 41.5	51.1
N 11	44 43.9	8 39.4	42.6	8 34.7	47.6	19 04.8	26.8	213 44.0	51.1
D 12	59 46.3	23 39.0	N12 43.6	23 35.3	N13 48.2	34 06.8	N 9 27.0	228 46.6	S 1 51.0
A 13	74 48.8	38 38.5	44.7	38 36.0	48.8	49 08.7	27.2	243 49.1	51.0
Y 14	89 51.3	53 38.0	45.7	53 36.7	49.5	64 10.7	27.4	258 51.7	51.0
15	104 53.7	68 37.6	46.7	68 37.3	50.1	79 12.6	27.6	273 54.2	51.0
16	119 56.2	83 37.1	47.7	83 38.0	50.7	94 14.5	27.8	288 56.8	50.9
17	134 58.7	98 36.6	48.7	98 38.6	51.3	109 16.5	28.0	303 59.3	50.9
18	150 01.1	113 36.1	N12 49.7	113 39.3	N13 51.9	124 18.4	N 9 28.2	319 01.9	S 1 50.9
19	165 03.6	128 35.7	50.8	128 40.0	52.6	139 20.4	28.4	334 04.4	50.8
20	180 06.0	143 35.2	51.8	143 40.6	53.2	154 22.3	28.6	349 07.0	50.8
21	195 08.5	158 34.7	52.8	158 41.3	53.8	169 24.3	28.8	4 09.5	50.8
22	210 11.0	173 34.3	53.8	173 41.9	54.4	184 26.2	28.9	19 12.1	50.8
23	225 13.4	188 33.8	54.8	188 42.6	55.0	199 28.1	29.1	34 14.6	50.7
23 00	240 15.9	203 33.3	N12 55.8	203 43.3	N13 55.7	214 30.1	N 9 29.3	49 17.2	S 1 50.7
01	255 18.4	218 32.8	56.8	218 43.9	56.3	229 32.0	29.5	64 19.7	50.7
02	270 20.8	233 32.4	57.9	233 44.6	56.9	244 34.0	29.7	79 22.2	50.7
03	285 23.3	248 31.9	58.9	248 45.2	57.5	259 35.9	29.9	94 24.8	50.6
04	300 25.8	263 31.4	12 59.9	263 45.9	58.1	274 37.9	30.1	109 27.3	50.6
05	315 28.2	278 30.9	13 00.9	278 46.6	58.7	289 39.8	30.3	124 29.9	50.6
06	330 30.7	293 30.5	N13 01.9	293 47.2	N13 59.4	304 41.8	N 9 30.5	139 32.4	S 1 50.6
07	345 33.2	308 30.0	02.9	308 47.9	14 00.0	319 43.7	30.7	154 35.0	50.5
08	0 35.6	323 29.5	03.9	323 48.5	00.6	334 45.6	30.9	169 37.5	50.5
M 09	15 38.1	338 29.0	04.9	338 49.2	01.2	349 47.6	31.1	184 40.1	50.5
O 10	30 40.5	353 28.6	05.9	353 49.8	01.8	4 49.5	31.3	199 42.6	50.5
N 11	45 43.0	8 28.1	06.9	8 50.5	02.4	19 51.5	31.5	214 45.2	50.4
D 12	60 45.5	23 27.6	N13 08.0	23 51.2	N14 03.0	34 53.4	N 9 31.7	229 47.7	S 1 50.4
A 13	75 47.9	38 27.1	09.0	38 51.8	03.7	49 55.4	31.8	244 50.3	50.4
Y 14	90 50.4	53 26.7	10.0	53 52.5	04.3	64 57.3	32.0	259 52.8	50.4
15	105 52.9	68 26.2	11.0	68 53.1	04.9	79 59.3	32.2	274 55.3	50.3
16	120 55.3	83 25.7	12.0	83 53.8	05.5	95 01.2	32.4	289 57.9	50.3
17	135 57.8	98 25.2	13.0	98 54.4	06.1	110 03.1	32.6	305 00.4	50.3
18	151 00.3	113 24.7	N13 14.0	113 55.1	N14 06.7	125 05.1	N 9 32.8	320 03.0	S 1 50.3
19	166 02.7	128 24.3	15.0	128 55.8	07.3	140 07.0	33.0	335 05.5	50.2
20	181 05.2	143 23.8	16.0	143 56.4	08.0	155 09.0	33.2	350 08.1	50.2
21	196 07.6	158 23.3	17.0	158 57.1	08.6	170 10.9	33.4	5 10.6	50.2
22	211 10.1	173 22.8	18.0	173 57.7	09.2	185 12.9	33.6	20 13.2	50.2
23	226 12.6	188 22.3	19.0	188 58.4	09.8	200 14.8	33.8	35 15.7	50.1
24 00	241 15.0	203 21.8	N13 20.0	203 59.1	N14 10.4	215 16.8	N 9 34.0	50 18.2	S 1 50.1
01	256 17.5	218 21.4	21.0	218 59.7	11.0	230 18.7	34.2	65 20.8	50.1
02	271 20.0	233 20.9	22.0	234 00.4	11.6	245 20.7	34.3	80 23.3	50.1
03	286 22.4	248 20.4	23.0	249 01.0	12.2	260 22.6	34.5	95 25.9	50.0
04	301 24.9	263 19.9	24.0	264 01.7	12.8	275 24.6	34.7	110 28.4	50.0
05	316 27.4	278 19.4	25.0	279 02.3	13.5	290 26.5	34.9	125 31.0	50.0
06	331 29.8	293 18.9	N13 26.0	294 03.0	N14 14.1	305 28.4	N 9 35.1	140 33.5	S 1 50.0
07	346 32.3	308 18.5	27.0	309 03.6	14.7	320 30.4	35.3	155 36.0	50.0
T 08	1 34.8	323 18.0	28.0	324 04.3	15.3	335 32.3	35.5	170 38.6	49.9
U 09	16 37.2	338 17.5	29.0	339 05.0	15.9	350 34.3	35.7	185 41.1	49.9
E 10	31 39.7	353 17.0	30.0	354 05.6	16.5	5 36.2	35.9	200 43.7	49.9
S 11	46 42.1	8 16.5	31.0	9 06.3	17.1	20 38.2	36.1	215 46.2	49.9
D 12	61 44.6	23 16.0	N13 32.0	24 06.9	N14 17.7	35 40.1	N 9 36.3	230 48.8	S 1 49.8
A 13	76 47.1	38 15.5	33.0	39 07.6	18.3	50 42.1	36.5	245 51.3	49.8
Y 14	91 49.5	53 15.0	34.0	54 08.2	18.9	65 44.0	36.6	260 53.8	49.8
15	*106 52.0	68 14.6	35.0	69 08.9	19.5	80 46.0	36.8	275 56.4	49.8
16	121 54.5	83 14.1	36.0	84 09.6	20.1	95 47.9	37.0	290 58.9	49.7
17	136 56.9	98 13.6	36.9	99 10.2	20.8	110 49.9	37.2	306 01.5	49.7
18	151 59.4	113 13.1	N13 37.9	114 10.9	N14 21.4	125 51.8	N 9 37.4	321 04.0	S 1 49.7
19	167 01.9	128 12.6	38.9	129 11.5	22.0	140 53.8	37.6	336 06.5	49.7
20	182 04.3	143 12.1	39.9	144 12.2	22.6	155 55.7	37.8	351 09.1	49.7
21	197 06.8	158 11.6	40.9	159 12.8	23.2	170 57.6	38.0	6 11.6	49.6
22	212 09.3	173 11.1	41.9	174 13.5	23.8	185 59.6	38.2	21 14.2	49.6
23	227 11.7	188 10.6	42.9	189 14.1	24.4	201 01.5	38.4	36 16.7	49.6
	h m								
Mer. Pass.	7 57.6	*v* −0.5	*d* 1.0	*v* 0.7	*d* 0.6	*v* 1.9	*d* 0.2	*v* 2.5	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.5
Achernar	335 28.3	S57 10.5
Acrux	173 10.6	S63 10.1
Adhara	255 14.0	S28 59.5
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.5	N55 54.0
Alkaid	152 59.6	N49 15.4
Al Na'ir	27 45.5	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.5
Alpheratz	357 45.2	N29 09.1
Altair	62 09.5	N 8 53.9
Ankaa	353 17.3	S42 14.4
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.3
Atria	107 30.3	S69 02.8
Avior	234 19.0	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.3	S52 42.3
Capella	280 37.1	N46 00.5
Deneb	49 32.3	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.6	S17 55.3
Dubhe	193 53.3	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.3	N51 29.1
Enif	33 48.5	N 9 55.6
Fomalhaut	15 25.6	S29 33.5
Gacrux	172 02.3	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.5	S60 25.9
Hamal	328 02.8	N23 30.9
Kaus Aust.	83 45.4	S34 22.6
Kochab	137 18.7	N74 06.6
Markab	13 39.9	N15 16.0
Menkar	314 16.9	N 4 08.0
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.4	S69 46.3
Mirfak	308 43.0	N49 54.0
Nunki	75 59.9	S26 16.8
Peacock	53 21.2	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.5	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.1
Sabik	102 13.9	S15 44.3
Schedar	349 42.6	N56 35.8
Shaula	96 23.5	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.7	S43 29.1
Vega	80 39.6	N38 47.6
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	323 17.4	10 26
Mars	323 27.4	10 25
Jupiter	334 14.2	9 41
Saturn	169 01.3	20 39

UT	SUN			MOON					Lat.	Twilight		Sunrise	Moonrise			
	GHA		Dec	GHA	v	Dec	d	HP		Naut.	Civil		22	23	24	25
d h	° ′		° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
22 00	180 50.9		N20 16.3	299 09.1	11.0	S17 28.3	8.8	56.5	N 72	▭	▭	▭	02 56	02 02	01 34	01 13
01	195 50.9		16.8	313 39.1	11.2	17 19.5	8.9	56.5	N 70	▭	▭	▭	02 03	01 37	01 21	01 07
02	210 50.8		17.3	328 09.3	11.2	17 10.6	9.0	56.4	68	////	////	00 57	01 29	01 18	01 10	01 02
03	225 50.8	. .	17.8	342 39.5	11.3	17 01.6	9.0	56.4	66	////	////	01 51	01 05	01 03	01 00	00 58
04	240 50.7		18.3	357 09.8	11.4	16 52.6	9.1	56.4	64	////	////	02 24	00 46	00 50	00 53	00 54
05	255 50.7		18.8	11 40.2	11.5	16 43.5	9.2	56.3	62	////	01 16	02 47	00 30	00 40	00 46	00 51
06	270 50.6	N20	19.3	26 10.7	11.6	S16 34.3	9.3	56.3	60	////	01 55	03 06	00 17	00 30	00 40	00 48
07	285 50.6		19.8	40 41.3	11.7	16 25.0	9.3	56.3	N 58	////	02 21	03 21	00 06	00 22	00 35	00 46
08	300 50.5		20.3	55 12.0	11.7	16 15.7	9.4	56.2	56	01 09	02 41	03 34	24 15	00 15	00 30	00 43
S 09	315 50.5	. .	20.8	69 42.7	11.9	16 06.3	9.4	56.2	54	01 44	02 58	03 46	24 09	00 09	00 26	00 41
U 10	330 50.5		21.3	84 13.6	11.9	15 56.9	9.6	56.2	52	02 09	03 12	03 56	24 03	00 03	00 22	00 40
N 11	345 50.4		21.8	98 44.5	12.0	15 47.3	9.5	56.1	50	02 28	03 24	04 05	23 58	24 19	00 19	00 38
D 12	0 50.4	N20	22.3	113 15.5	12.2	S15 37.8	9.7	56.1	45	03 03	03 48	04 23	23 46	24 12	00 12	00 34
A 13	15 50.3		22.8	127 46.7	12.2	15 28.1	9.7	56.1	N 40	03 28	04 07	04 39	23 37	24 05	00 05	00 31
Y 14	30 50.3		23.3	142 17.9	12.3	15 18.4	9.8	56.1	35	03 48	04 23	04 51	23 29	24 00	00 00	00 28
15	45 50.2	. .	23.8	156 49.2	12.3	15 08.6	9.8	56.0	30	04 04	04 36	05 03	23 22	23 55	24 26	00 26
16	60 50.2		24.3	171 20.5	12.5	14 58.8	9.9	56.0	20	04 29	04 58	05 22	23 09	23 47	24 22	00 22
17	75 50.1		24.8	185 52.0	12.5	14 48.9	9.9	56.0	N 10	04 49	05 15	05 38	22 58	23 40	24 18	00 18
18	90 50.1	N20	25.2	200 23.5	12.7	S14 39.0	10.0	55.9	0	05 05	05 31	05 53	22 48	23 33	24 15	00 15
19	105 50.0		25.7	214 55.2	12.7	14 29.0	10.1	55.9	S 10	05 20	05 46	06 08	22 38	23 26	24 12	00 12
20	120 50.0		26.2	229 26.9	12.8	14 18.9	10.1	55.9	20	05 34	06 01	06 24	22 27	23 18	24 08	00 08
21	135 49.9	. .	26.7	243 58.7	12.8	14 08.8	10.2	55.8	30	05 47	06 17	06 42	22 14	23 10	24 04	00 04
22	150 49.9		27.2	258 30.5	13.0	13 58.6	10.2	55.8	35	05 55	06 26	06 53	22 07	23 05	24 01	00 01
23	165 49.9		27.7	273 02.5	13.0	13 48.4	10.3	55.8	40	06 02	06 35	07 05	21 58	23 00	23 59	24 57
23 00	180 49.8	N20	28.2	287 34.5	13.1	S13 38.1	10.3	55.7	45	06 11	06 47	07 19	21 48	22 53	23 56	24 57
01	195 49.8		28.7	302 06.6	13.2	13 27.8	10.3	55.7	S 50	06 20	07 00	07 37	21 37	22 45	23 52	24 57
02	210 49.7		29.1	316 38.8	13.2	13 17.5	10.5	55.7	52	06 24	07 06	07 45	21 31	22 42	23 50	24 57
03	225 49.7	. .	29.6	331 11.0	13.4	13 07.0	10.4	55.7	54	06 28	07 13	07 54	21 25	22 38	23 48	24 57
04	240 49.6		30.1	345 43.4	13.4	12 56.6	10.5	55.6	56	06 33	07 20	08 04	21 18	22 33	23 46	24 57
05	255 49.6		30.6	0 15.8	13.5	12 46.1	10.6	55.6	58	06 38	07 28	08 16	21 10	22 28	23 44	24 58
06	270 49.5	N20	31.1	14 48.3	13.5	S12 35.5	10.6	55.6	S 60	06 44	07 37	08 29	21 02	22 23	23 41	24 58
07	285 49.5		31.6	29 20.8	13.6	12 24.9	10.6	55.5								
08	300 49.4		32.0	43 53.4	13.7	12 14.3	10.7	55.5								
M 09	315 49.4	. .	32.5	58 26.1	13.8	12 03.6	10.7	55.5								
O 10	330 49.3		33.0	72 58.9	13.8	11 52.9	10.8	55.5								
N 11	345 49.3		33.5	87 31.7	14.0	11 42.1	10.8	55.4								
D 12	0 49.2	N20	34.0	102 04.7	13.9	S11 31.3	10.9	55.4								
A 13	15 49.2		34.4	116 37.6	14.1	11 20.4	10.8	55.4								
Y 14	30 49.1		34.9	131 10.7	14.1	11 09.6	11.0	55.4								
15	45 49.0	. .	35.4	145 43.8	14.1	10 58.6	10.9	55.3								
16	60 49.0		35.9	160 16.9	14.3	10 47.7	11.0	55.3								
17	75 48.9		36.4	174 50.2	14.3	10 36.7	11.0	55.3								
18	90 48.9	N20	36.8	189 23.5	14.3	S10 25.7	11.1	55.3								
19	105 48.8		37.3	203 56.8	14.5	10 14.6	11.1	55.2								
20	120 48.8		37.8	218 30.3	14.4	10 03.5	11.1	55.2								
21	135 48.7	. .	38.2	233 03.7	14.6	9 52.4	11.2	55.2								
22	150 48.7		38.7	247 37.3	14.6	9 41.2	11.2	55.2								
23	165 48.6		39.2	262 10.9	14.6	9 30.0	11.2	55.1								
24 00	180 48.6	N20	39.7	276 44.5	14.7	S 9 18.8	11.2	55.1								
01	195 48.5		40.1	291 18.2	14.8	9 07.6	11.3	55.1								
02	210 48.5		40.6	305 52.0	14.8	8 56.3	11.3	55.1								
03	225 48.4	. .	41.1	320 25.8	14.9	8 45.0	11.3	55.0								
04	240 48.4		41.5	334 59.7	14.9	8 33.7	11.4	55.0								
05	255 48.3		42.0	349 33.6	15.0	8 22.3	11.3	55.0								
06	270 48.2	N20	42.5	4 07.6	15.0	S 8 11.0	11.4	55.0								
07	285 48.2		43.0	18 41.6	15.1	7 59.6	11.5	54.9								
T 08	300 48.1		43.4	33 15.7	15.1	7 48.1	11.4	54.9								
U 09	315 48.1	. .	43.9	47 49.8	15.2	7 36.7	11.5	54.9								
E 10	330 48.0		44.4	62 24.0	15.2	7 25.2	11.5	54.9								
S 11	345 48.0		44.8	76 58.2	15.3	7 13.7	11.5	54.9								
D 12	0 47.9	N20	45.3	91 32.5	15.3	S 7 02.2	11.5	54.8								
A 13	15 47.8		45.7	106 06.8	15.3	6 50.7	11.5	54.8								
Y 14	30 47.8		46.2	120 41.1	15.4	6 39.2	11.6	54.8								
15	45 47.7	. .	46.7	135 15.5	15.5	6 27.6	11.6	54.8								
16	60 47.7		47.1	149 50.0	15.4	6 16.0	11.6	54.8								
17	75 47.6		47.6	164 24.4	15.6	6 04.4	11.6	54.7								
18	90 47.6	N20	48.1	178 59.0	15.5	S 5 52.8	11.6	54.7								
19	105 47.5		48.5	193 33.5	15.6	5 41.2	11.7	54.7								
20	120 47.4		49.0	208 08.1	15.6	5 29.5	11.6	54.7								
21	135 47.4	. .	49.4	222 42.7	15.7	5 17.9	11.7	54.7								
22	150 47.3		49.9	237 17.4	15.7	5 06.2	11.7	54.7								
23	165 47.3		50.3	251 52.1	15.7	S 4 54.5	11.7	54.6								
	SD 15.8		d 0.5	SD 15.3		15.1		14.9								

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	22	23	24	25
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	05 44	08 16	10 16	12 04
N 70	▭	▭	▭	06 37	08 39	10 27	12 08
68	23 05	////	////	07 09	08 57	10 36	12 10
66	22 06	////	////	07 32	09 11	10 44	12 13
64	21 32	////	////	07 50	09 23	10 50	12 15
62	21 08	22 42	////	08 05	09 32	10 56	12 17
60	20 49	22 01	////	08 18	09 41	11 01	12 18
N 58	20 34	21 35	////	08 28	09 48	11 05	12 19
56	20 20	21 14	22 49	08 38	09 54	11 08	12 21
54	20 09	20 57	22 12	08 46	10 00	11 12	12 22
52	19 59	20 43	21 47	08 53	10 05	11 15	12 23
50	19 50	20 31	21 27	09 00	10 10	11 17	12 23
45	19 31	20 06	20 52	09 14	10 20	11 23	12 25
N 40	19 15	19 47	20 26	09 26	10 28	11 28	12 27
35	19 02	19 31	20 06	09 35	10 35	11 32	12 28
30	18 51	19 18	19 50	09 44	10 41	11 36	12 29
20	18 32	18 56	19 24	09 59	10 52	11 43	12 31
N 10	18 16	18 38	19 05	10 11	11 01	11 48	12 33
0	18 00	18 22	18 48	10 23	11 10	11 53	12 35
S 10	17 45	18 08	18 33	10 35	11 18	11 58	12 36
20	17 29	17 53	18 20	10 48	11 27	12 04	12 38
30	17 11	17 37	18 06	11 02	11 38	12 10	12 40
35	17 00	17 28	17 59	11 10	11 44	12 13	12 41
40	16 48	17 18	17 51	11 20	11 50	12 17	12 42
45	16 34	17 06	17 43	11 31	11 58	12 22	12 44
S 50	16 16	16 53	17 33	11 44	12 07	12 27	12 46
52	16 08	16 47	17 29	11 50	12 12	12 30	12 46
54	15 59	16 40	17 25	11 57	12 16	12 33	12 47
56	15 49	16 33	17 20	12 04	12 21	12 36	12 48
58	15 37	16 25	17 15	12 12	12 27	12 39	12 49
S 60	15 24	16 15	17 09	12 22	12 34	12 43	12 50

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
22	03 24	03 22	11 57	04 12	16 36	19	72
23	03 19	03 17	11 57	04 59	17 21	20	63
24	03 14	03 12	11 57	05 43	18 04	21	53

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
25 00	242 14.2	203 10.1	N13 43.9	204 14.8	N14 25.0	216 03.5	N 9 38.6	51 19.2	S 1 49.6
01	257 16.6	218 09.6	44.9	219 15.5	25.6	231 05.4	38.7	66 21.8	49.5
02	272 19.1	233 09.2	45.8	234 16.1	26.2	246 07.4	38.9	81 24.3	49.5
03	287 21.6	248 08.7	46.8	249 16.8	26.8	261 09.3	39.1	96 26.9	49.5
04	302 24.0	263 08.2	47.8	264 17.4	27.4	276 11.3	39.3	111 29.4	49.5
05	317 26.5	278 07.7	48.8	279 18.1	28.0	291 13.2	39.5	126 31.9	49.4
06	332 29.0	293 07.2	N13 49.8	294 18.7	N14 28.6	306 15.2	N 9 39.7	141 34.5	S 1 49.4
W 07	347 31.4	308 06.7	50.8	309 19.4	29.2	321 17.1	39.9	156 37.0	49.4
E 08	2 33.9	323 06.2	51.8	324 20.0	29.8	336 19.1	40.1	171 39.6	49.4
D 09	17 36.4	338 05.7	52.7	339 20.7	30.4	351 21.0	40.3	186 42.1	49.4
N 10	32 38.8	353 05.2	53.7	354 21.3	31.0	6 23.0	40.5	201 44.6	49.3
E 11	47 41.3	8 04.7	54.7	9 22.0	31.6	21 24.9	40.7	216 47.2	49.3
S 12	62 43.7	23 04.2	N13 55.7	24 22.7	N14 32.2	36 26.9	N 9 40.8	231 49.7	S 1 49.3
D 13	77 46.2	38 03.7	56.7	39 23.3	32.8	51 28.8	41.0	246 52.3	49.3
A 14	92 48.7	53 03.2	57.6	54 24.0	33.4	66 30.8	41.2	261 54.8	49.3
Y 15	107 51.1	68 02.7	58.6	69 24.6	34.0	81 32.7	41.4	276 57.3	49.2
16	122 53.6	83 02.2	13 59.6	84 25.3	34.6	96 34.7	41.6	291 59.9	49.2
17	137 56.1	98 01.7	14 00.6	99 25.9	35.2	111 36.6	41.8	307 02.4	49.2
18	152 58.5	113 01.2	N14 01.6	114 26.6	N14 35.8	126 38.6	N 9 42.0	322 04.9	S 1 49.2
19	168 01.0	128 00.7	02.5	129 27.2	36.4	141 40.5	42.2	337 07.5	49.1
20	183 03.5	143 00.2	03.5	144 27.9	37.0	156 42.5	42.4	352 10.0	49.1
21	198 05.9	157 59.7	04.5	159 28.5	37.6	171 44.4	42.6	7 12.6	49.1
22	213 08.4	172 59.2	05.5	174 29.2	38.2	186 46.4	42.7	22 15.1	49.1
23	228 10.9	187 58.7	06.4	189 29.8	38.8	201 48.3	42.9	37 17.6	49.1
26 00	243 13.3	202 58.2	N14 07.4	204 30.5	N14 39.4	216 50.3	N 9 43.1	52 20.2	S 1 49.0
01	258 15.8	217 57.7	08.4	219 31.2	40.0	231 52.2	43.3	67 22.7	49.0
02	273 18.2	232 57.2	09.4	234 31.8	40.6	246 54.2	43.5	82 25.2	49.0
03	288 20.7	247 56.7	10.3	249 32.5	41.2	261 56.1	43.7	97 27.8	49.0
04	303 23.2	262 56.2	11.3	264 33.1	41.8	276 58.1	43.9	112 30.3	49.0
05	318 25.6	277 55.7	12.3	279 33.8	42.4	292 00.0	44.1	127 32.8	48.9
06	333 28.1	292 55.2	N14 13.3	294 34.4	N14 43.0	307 02.0	N 9 44.3	142 35.4	S 1 48.9
T 07	348 30.6	307 54.6	14.2	309 35.1	43.6	322 03.9	44.4	157 37.9	48.9
H 08	3 33.0	322 54.1	15.2	324 35.7	44.2	337 05.9	44.6	172 40.5	48.9
U 09	18 35.5	337 53.6	16.2	339 36.4	44.8	352 07.8	44.8	187 43.0	48.9
R 10	33 38.0	352 53.1	17.1	354 37.0	45.4	7 09.8	45.0	202 45.5	48.8
S 11	48 40.4	7 52.6	18.1	9 37.7	46.0	22 11.7	45.2	217 48.1	48.8
D 12	63 42.9	22 52.1	N14 19.1	24 38.3	N14 46.6	37 13.7	N 9 45.4	232 50.6	S 1 48.8
A 13	78 45.3	37 51.6	20.0	39 39.0	47.2	52 15.6	45.6	247 53.1	48.8
Y 14	93 47.8	52 51.1	21.0	54 39.6	47.8	67 17.6	45.8	262 55.7	48.8
15	108 50.3	67 50.6	22.0	69 40.3	48.4	82 19.5	46.0	277 58.2	48.7
16	123 52.7	82 50.1	22.9	84 40.9	49.0	97 21.5	46.1	293 00.7	48.7
17	138 55.2	97 49.6	23.9	99 41.6	49.6	112 23.4	46.3	308 03.3	48.7
18	153 57.7	112 49.1	N14 24.9	114 42.2	N14 50.2	127 25.4	N 9 46.5	323 05.8	S 1 48.7
19	169 00.1	127 48.5	25.8	129 42.9	50.8	142 27.3	46.7	338 08.3	48.7
20	184 02.6	142 48.0	26.8	144 43.6	51.4	157 29.3	46.9	353 10.9	48.6
21	199 05.1	157 47.5	27.8	159 44.2	52.0	172 31.2	47.1	8 13.4	48.6
22	214 07.5	172 47.0	28.7	174 44.9	52.6	187 33.2	47.3	23 15.9	48.6
23	229 10.0	187 46.5	29.7	189 45.5	53.1	202 35.1	47.5	38 18.5	48.6
27 00	244 12.5	202 46.0	N14 30.6	204 46.2	N14 53.7	217 37.1	N 9 47.7	53 21.0	S 1 48.6
01	259 14.9	217 45.5	31.6	219 46.8	54.3	232 39.0	47.8	68 23.5	48.5
02	274 17.4	232 44.9	32.6	234 47.5	54.9	247 41.0	48.0	83 26.1	48.5
03	289 19.8	247 44.4	33.5	249 48.1	55.5	262 42.9	48.2	98 28.6	48.5
04	304 22.3	262 43.9	34.5	264 48.8	56.1	277 44.9	48.4	113 31.1	48.5
05	319 24.8	277 43.4	35.4	279 49.4	56.7	292 46.9	48.6	128 33.7	48.5
06	334 27.2	292 42.9	N14 36.4	294 50.1	N14 57.3	307 48.8	N 9 48.8	143 36.2	S 1 48.4
07	349 29.7	307 42.4	37.4	309 50.7	57.9	322 50.8	49.0	158 38.7	48.4
08	4 32.2	322 41.9	38.3	324 51.4	58.5	337 52.7	49.2	173 41.3	48.4
F 09	19 34.6	337 41.3	39.3	339 52.0	59.1	352 54.7	49.3	188 43.8	48.4
R 10	34 37.1	352 40.8	40.2	354 52.7	14 59.7	7 56.6	49.5	203 46.3	48.4
I 11	49 39.6	7 40.3	41.2	9 53.3	15 00.2	22 58.6	49.7	218 48.9	48.3
D 12	64 42.0	22 39.8	N14 42.1	24 54.0	N15 00.8	38 00.5	N 9 49.9	233 51.4	S 1 48.3
A 13	79 44.5	37 39.3	43.1	39 54.6	01.4	53 02.5	50.1	248 53.9	48.3
Y 14	94 47.0	52 38.7	44.0	54 55.3	02.0	68 04.4	50.3	263 56.4	48.3
15	109 49.4	67 38.2	45.0	69 55.9	02.6	83 06.4	50.5	278 59.0	48.3
16	124 51.9	82 37.7	45.9	84 56.6	03.2	98 08.3	50.7	294 01.5	48.3
17	139 54.3	97 37.2	46.9	99 57.2	03.8	113 10.3	50.8	309 04.0	48.2
18	154 56.8	112 36.7	N14 47.8	114 57.9	N15 04.4	128 12.2	N 9 51.0	324 06.6	S 1 48.2
19	169 59.3	127 36.1	48.8	129 58.5	04.9	143 14.2	51.2	339 09.1	48.2
20	185 01.7	142 35.6	49.7	144 59.2	05.5	158 16.1	51.4	354 11.6	48.2
21	200 04.2	157 35.1	50.7	159 59.8	06.1	173 18.1	51.6	9 14.2	48.2
22	215 06.7	172 34.6	51.6	175 00.5	06.7	188 20.1	51.8	24 16.7	48.1
23	230 09.1	187 34.0	52.6	190 01.1	07.3	203 22.0	52.0	39 19.2	48.1
	h m								
Mer. Pass.	7 45.8	*v* −0.5	*d* 1.0	*v* 0.7	*d* 0.6	*v* 2.0	*d* 0.2	*v* 2.5	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.5
Achernar	335 28.2	S57 10.5
Acrux	173 10.7	S63 10.1
Adhara	255 14.0	S28 59.5
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.5	N55 54.0
Alkaid	152 59.6	N49 15.4
Al Na'ir	27 45.5	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.5
Alpheratz	357 45.2	N29 09.1
Altair	62 09.5	N 8 53.9
Ankaa	353 17.3	S42 14.4
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.3
Atria	107 30.3	S69 02.8
Avior	234 19.0	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.3	S52 42.3
Capella	280 37.1	N46 00.5
Deneb	49 32.3	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.5	S17 55.3
Dubhe	193 53.3	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.3	N51 29.2
Enif	33 48.5	N 9 55.6
Fomalhaut	15 25.6	S29 33.5
Gacrux	172 02.3	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.5	S60 25.9
Hamal	328 02.7	N23 30.9
Kaus Aust.	83 45.4	S34 22.6
Kochab	137 18.7	N74 06.6
Markab	13 39.9	N15 16.0
Menkar	314 16.9	N 4 08.0
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.4	S69 46.3
Mirfak	308 43.0	N49 54.0
Nunki	75 59.8	S26 16.8
Peacock	53 21.2	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.5	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.1
Sabik	102 13.9	S15 44.3
Schedar	349 42.6	N56 35.8
Shaula	96 23.5	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.7	S43 29.1
Vega	80 39.6	N38 47.6
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	319 44.9	10 28
Mars	321 17.2	10 22
Jupiter	333 36.9	9 31
Saturn	169 06.8	20 27

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
25 00	180 47.2	N20 50.8	266 26.8	15.8	S 4 42.8	11.7	54.6
01	195 47.1	51.3	281 01.6	15.8	4 31.1	11.7	54.6
02	210 47.1	51.7	295 36.4	15.8	4 19.4	11.7	54.6
03	225 47.0	52.2	310 11.2	15.9	4 07.7	11.8	54.6
04	240 47.0	52.6	324 46.1	15.8	3 55.9	11.7	54.6
05	255 46.9	53.1	339 20.9	16.0	3 44.2	11.8	54.5
06	270 46.8	N20 53.5	353 55.9	15.9	S 3 32.4	11.7	54.5
W 07	285 46.8	54.0	8 30.8	16.0	3 20.7	11.8	54.5
E 08	300 46.7	54.4	23 05.8	15.9	3 08.9	11.8	54.5
D 09	315 46.7	54.9	37 40.7	16.0	2 57.1	11.7	54.5
N 10	330 46.6	55.3	52 15.7	16.1	2 45.4	11.8	54.5
E 11	345 46.5	55.8	66 50.8	16.0	2 33.6	11.8	54.5
S 12	0 46.5	N20 56.2	81 25.8	16.1	S 2 21.8	11.8	54.4
D 13	15 46.4	56.7	96 00.9	16.1	2 10.0	11.8	54.4
A 14	30 46.3	57.1	110 36.0	16.1	1 58.2	11.8	54.4
Y 15	45 46.3	57.6	125 11.1	16.1	1 46.4	11.8	54.4
16	60 46.2	58.0	139 46.2	16.2	1 34.6	11.8	54.4
17	75 46.2	58.5	154 21.4	16.1	1 22.8	11.8	54.4
18	90 46.1	N20 58.9	168 56.5	16.2	S 1 11.0	11.8	54.4
19	105 46.0	59.4	183 31.7	16.2	0 59.2	11.8	54.4
20	120 46.0	20 59.8	198 06.9	16.2	0 47.4	11.8	54.3
21	135 45.9	21 00.3	212 42.1	16.2	0 35.6	11.8	54.3
22	150 45.8	00.7	227 17.3	16.2	0 23.8	11.8	54.3
23	165 45.8	01.1	241 52.5	16.3	0 12.0	11.8	54.3
26 00	180 45.7	N21 01.6	256 27.8	16.2	S 0 00.2	11.7	54.3
01	195 45.6	02.0	271 03.0	16.3	N 0 11.5	11.8	54.3
02	210 45.6	02.5	285 38.3	16.2	0 23.3	11.8	54.3
03	225 45.5	02.9	300 13.5	16.3	0 35.1	11.8	54.3
04	240 45.4	03.3	314 48.8	16.3	0 46.9	11.7	54.3
05	255 45.4	03.8	329 24.1	16.2	0 58.6	11.8	54.3
06	270 45.3	N21 04.2	343 59.3	16.3	N 1 10.4	11.7	54.3
07	285 45.2	04.7	358 34.6	16.3	1 22.1	11.8	54.2
T 08	300 45.2	05.1	13 09.9	16.3	1 33.9	11.7	54.2
H 09	315 45.1	05.5	27 45.2	16.2	1 45.6	11.7	54.2
U 10	330 45.0	06.0	42 20.4	16.3	1 57.3	11.8	54.2
R 11	345 45.0	06.4	56 55.7	16.3	2 09.1	11.7	54.2
S 12	0 44.9	N21 06.8	71 31.0	16.3	N 2 20.8	11.7	54.2
D 13	15 44.8	07.3	86 06.3	16.2	2 32.5	11.6	54.2
A 14	30 44.8	07.7	100 41.5	16.3	2 44.1	11.7	54.2
Y 15	45 44.7	08.1	115 16.8	16.2	2 55.8	11.7	54.2
16	60 44.6	08.6	129 52.0	16.3	3 07.5	11.6	54.2
17	75 44.6	09.0	144 27.3	16.2	3 19.1	11.6	54.2
18	90 44.5	N21 09.4	159 02.5	16.3	N 3 30.7	11.7	54.2
19	105 44.4	09.9	173 37.8	16.2	3 42.4	11.6	54.2
20	120 44.4	10.3	188 13.0	16.2	3 54.0	11.5	54.2
21	135 44.3	10.7	202 48.2	16.2	4 05.5	11.6	54.2
22	150 44.2	11.2	217 23.4	16.2	4 17.1	11.6	54.2
23	165 44.2	11.6	231 58.6	16.2	4 28.7	11.5	54.2
27 00	180 44.1	N21 12.0	246 33.8	16.1	N 4 40.2	11.5	54.2
01	195 44.0	12.4	261 08.9	16.2	4 51.7	11.5	54.2
02	210 43.9	12.9	275 44.1	16.1	5 03.2	11.5	54.1
03	225 43.9	13.3	290 19.2	16.1	5 14.7	11.4	54.1
04	240 43.8	13.7	304 54.3	16.1	5 26.1	11.5	54.1
05	255 43.7	14.1	319 29.4	16.1	5 37.6	11.4	54.1
06	270 43.7	N21 14.6	334 04.5	16.1	N 5 49.0	11.4	54.1
07	285 43.6	15.0	348 39.6	16.0	6 00.4	11.4	54.1
08	300 43.5	15.4	3 14.6	16.0	6 11.8	11.3	54.1
F 09	315 43.4	15.8	17 49.6	16.0	6 23.1	11.3	54.1
R 10	330 43.4	16.2	32 24.6	16.0	6 34.4	11.3	54.1
I 11	345 43.3	16.7	46 59.6	16.0	6 45.7	11.3	54.1
D 12	0 43.2	N21 17.1	61 34.6	15.9	N 6 57.0	11.3	54.1
A 13	15 43.2	17.5	76 09.5	15.9	7 08.3	11.2	54.1
Y 14	30 43.1	17.9	90 44.4	15.9	7 19.5	11.2	54.1
15	45 43.0	18.3	105 19.3	15.8	7 30.7	11.2	54.1
16	60 42.9	18.7	119 54.1	15.8	7 41.9	11.1	54.1
17	75 42.9	19.2	134 28.9	15.8	7 53.0	11.1	54.1
18	90 42.8	N21 19.6	149 03.7	15.8	N 8 04.1	11.1	54.1
19	105 42.7	20.0	163 38.5	15.7	8 15.2	11.1	54.2
20	120 42.6	20.4	178 13.2	15.7	8 26.3	11.0	54.2
21	135 42.6	20.8	192 47.9	15.7	8 37.3	11.0	54.2
22	150 42.5	21.2	207 22.6	15.6	8 48.3	10.9	54.2
23	165 42.4	21.6	221 57.2	15.6	N 8 59.2	11.0	54.2
	SD 15.8	d 0.4	SD	14.8		14.8	14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 25	Moonrise 26	Moonrise 27	Moonrise 28
°	h m	h m	h m	h m	h m	h m	h m
N 72				01 13	00 55	00 36	(00 23) (16 50)
N 70				01 07	00 55	00 43	00 29
68	////	////	00 24	01 02	00 55	00 48	00 41
66	////	////	01 39	00 58	00 55	00 52	00 50
64	////	////	02 15	00 54	00 55	00 56	00 58
62	////	01 01	02 40	00 51	00 55	00 59	01 04
60	////	01 45	03 00	00 48	00 55	01 02	01 10
N 58	////	02 14	03 16	00 46	00 55	01 05	01 15
56	00 55	02 35	03 30	00 43	00 55	01 07	01 20
54	01 36	02 53	03 42	00 41	00 55	01 09	01 24
52	02 02	03 07	03 52	00 40	00 55	01 11	01 28
50	02 22	03 20	04 01	00 38	00 55	01 13	01 31
45	02 59	03 45	04 21	00 34	00 55	01 17	01 39
N 40	03 26	04 05	04 37	00 31	00 56	01 20	01 45
35	03 46	04 21	04 50	00 28	00 56	01 23	01 51
30	04 02	04 35	05 01	00 26	00 56	01 25	01 55
20	04 28	04 57	05 21	00 22	00 56	01 29	02 04
N 10	04 49	05 15	05 38	00 18	00 56	01 33	02 11
0	05 05	05 31	05 53	00 15	00 56	01 37	02 18
S 10	05 21	05 46	06 09	00 12	00 56	01 40	02 25
20	05 35	06 02	06 25	00 08	00 56	01 44	02 33
30	05 49	06 18	06 44	00 04	00 57	01 49	02 41
35	05 56	06 28	06 55	00 01	00 57	01 51	02 46
40	06 04	06 38	07 08	24 57	00 57	01 54	02 52
45	06 13	06 49	07 22	24 57	00 57	01 58	02 59
S 50	06 23	07 03	07 40	24 57	00 57	02 02	03 07
52	06 27	07 10	07 49	24 57	00 57	02 04	03 11
54	06 32	07 16	07 58	24 57	00 57	02 06	03 15
56	06 37	07 24	08 09	24 57	00 57	02 08	03 19
58	06 42	07 33	08 21	24 58	00 58	02 11	03 24
S 60	06 48	07 42	08 35	24 58	00 58	02 14	03 30

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 25	Moonset 26	Moonset 27	Moonset 28
°	h m	h m	h m	h m	h m	h m	h m
N 72				12 04	13 49	15 36	17 30
N 70				12 08	13 45	15 24	17 08
68				12 10	13 42	15 15	16 50
66	22 19	////	////	12 13	13 40	15 07	16 37
64	21 42	////	////	12 15	13 38	15 01	16 25
62	21 16	22 59	////	12 17	13 36	14 55	16 16
60	20 55	22 11	////	12 18	13 34	14 50	16 07
N 58	20 39	21 42	////	12 19	13 33	14 46	16 00
56	20 25	21 20	23 04	12 21	13 31	14 42	15 54
54	20 13	21 03	22 21	12 22	13 30	14 39	15 48
52	20 03	20 48	21 54	12 23	13 29	14 36	15 43
50	19 53	20 35	21 33	12 23	13 28	14 33	15 38
45	19 34	20 09	20 56	12 25	13 26	14 27	15 29
N 40	19 18	19 50	20 29	12 27	13 25	14 22	15 20
35	19 05	19 33	20 09	12 28	13 23	14 18	15 13
30	18 53	19 20	19 52	12 29	13 22	14 14	15 07
20	18 33	18 57	19 26	12 31	13 20	14 08	14 57
N 10	18 16	18 39	19 06	12 33	13 18	14 02	14 47
0	18 01	18 23	18 49	12 35	13 16	13 57	14 39
S 10	17 45	18 07	18 33	12 36	13 14	13 51	14 30
20	17 28	17 52	18 19	12 38	13 12	13 46	14 21
30	17 10	17 35	18 05	12 40	13 09	13 39	14 10
35	16 59	17 26	17 57	12 41	13 08	13 35	14 04
40	16 46	17 16	17 49	12 42	13 07	13 31	13 57
45	16 31	17 04	17 41	12 44	13 05	13 26	13 50
S 50	16 13	16 50	17 31	12 46	13 03	13 21	13 40
52	16 05	16 44	17 26	12 46	13 02	13 18	13 36
54	15 55	16 37	17 22	12 47	13 01	13 15	13 31
56	15 45	16 29	17 17	12 48	13 00	13 12	13 26
58	15 33	16 21	17 11	12 49	12 59	13 08	13 20
S 60	15 18	16 11	17 05	12 50	12 57	13 05	13 13

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d %	
25	03 09	03 06	11 57	06 25	18 45	22 43	
26	03 03	03 00	11 57	07 06	19 26	23 34	
27	02 56	02 53	11 57	07 47	20 07	24 25	

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
28 00	245 11.6	202 33.5	N14 53.5	205 01.8	N15 07.9	218 24.0	N 9 52.2	54 21.7	S 1 48.1
01	260 14.1	217 33.0	54.5	220 02.4	08.5	233 25.9	52.3	69 24.3	48.1
02	275 16.5	232 32.5	55.4	235 03.1	09.1	248 27.9	52.5	84 26.8	48.1
03	290 19.0	247 31.9	56.4	250 03.7	09.6	263 29.8	52.7	99 29.3	48.1
04	305 21.4	262 31.4	57.3	265 04.4	10.2	278 31.8	52.9	114 31.9	48.0
05	320 23.9	277 30.9	58.2	280 05.0	10.8	293 33.7	53.1	129 34.4	48.0
06	335 26.4	292 30.4	N14 59.2	295 05.7	N15 11.4	308 35.7	N 9 53.3	144 36.9	S 1 48.0
07	350 28.8	307 29.8	15 00.1	310 06.3	12.0	323 37.6	53.5	159 39.4	48.0
S 08	5 31.3	322 29.3	01.1	325 07.0	12.6	338 39.6	53.6	174 42.0	48.0
A 09	20 33.8	337 28.8	02.0	340 07.6	13.1	353 41.6	53.8	189 44.5	48.0
T 10	35 36.2	352 28.2	03.0	355 08.3	13.7	8 43.5	54.0	204 47.0	47.9
U 11	50 38.7	7 27.7	03.9	10 08.9	14.3	23 45.5	54.2	219 49.6	47.9
R 12	65 41.2	22 27.2	N15 04.8	25 09.6	N15 14.9	38 47.4	N 9 54.4	234 52.1	S 1 47.9
D 13	80 43.6	37 26.7	05.8	40 10.2	15.5	53 49.4	54.6	249 54.6	47.9
A 14	95 46.1	52 26.1	06.7	55 10.9	16.1	68 51.3	54.8	264 57.1	47.9
Y 15	110 48.6	67 25.6	07.6	70 11.5	16.6	83 53.3	54.9	279 59.7	47.9
16	125 51.0	82 25.1	08.6	85 12.2	17.2	98 55.2	55.1	295 02.2	47.8
17	140 53.5	97 24.5	09.5	100 12.8	17.8	113 57.2	55.3	310 04.7	47.8
18	155 55.9	112 24.0	N15 10.5	115 13.5	N15 18.4	128 59.2	N 9 55.5	325 07.3	S 1 47.8
19	170 58.4	127 23.5	11.4	130 14.1	19.0	144 01.1	55.7	340 09.8	47.8
20	186 00.9	142 22.9	12.3	145 14.8	19.5	159 03.1	55.9	355 12.3	47.8
21	201 03.3	157 22.4	13.3	160 15.4	20.1	174 05.0	56.1	10 14.8	47.8
22	216 05.8	172 21.9	14.2	175 16.1	20.7	189 07.0	56.2	25 17.4	47.7
23	231 08.3	187 21.3	15.1	190 16.7	21.3	204 08.9	56.4	40 19.9	47.7
29 00	246 10.7	202 20.8	N15 16.1	205 17.3	N15 21.9	219 10.9	N 9 56.6	55 22.4	S 1 47.7
01	261 13.2	217 20.3	17.0	220 18.0	22.4	234 12.9	56.8	70 24.9	47.7
02	276 15.7	232 19.7	17.9	235 18.6	23.0	249 14.8	57.0	85 27.5	47.7
03	291 18.1	247 19.2	18.8	250 19.3	23.6	264 16.8	57.2	100 30.0	47.7
04	306 20.6	262 18.6	19.8	265 19.9	24.2	279 18.7	57.4	115 32.5	47.6
05	321 23.1	277 18.1	20.7	280 20.6	24.8	294 20.7	57.5	130 35.0	47.6
06	336 25.5	292 17.6	N15 21.6	295 21.2	N15 25.3	309 22.6	N 9 57.7	145 37.6	S 1 47.6
07	351 28.0	307 17.0	22.6	310 21.9	25.9	324 24.6	57.9	160 40.1	47.6
08	6 30.4	322 16.5	23.5	325 22.5	26.5	339 26.6	58.1	175 42.6	47.6
S 09	21 32.9	337 16.0	24.4	340 23.2	27.1	354 28.5	58.3	190 45.1	47.6
U 10	36 35.4	352 15.4	25.3	355 23.8	27.6	9 30.5	58.5	205 47.7	47.6
N 11	51 37.8	7 14.9	26.3	10 24.5	28.2	24 32.4	58.7	220 50.2	47.5
D 12	66 40.3	22 14.3	N15 27.2	25 25.1	N15 28.8	39 34.4	N 9 58.8	235 52.7	S 1 47.5
A 13	81 42.8	37 13.8	28.1	40 25.8	29.4	54 36.3	59.0	250 55.2	47.5
Y 14	96 45.2	52 13.3	29.0	55 26.4	29.9	69 38.3	59.2	265 57.8	47.5
15	111 47.7	67 12.7	30.0	70 27.1	30.5	84 40.3	59.4	281 00.3	47.5
16	126 50.2	82 12.2	30.9	85 27.7	31.1	99 42.2	59.6	296 02.8	47.5
17	141 52.6	97 11.6	31.8	100 28.3	31.7	114 44.2	59.8	311 05.3	47.4
18	156 55.1	112 11.1	N15 32.7	115 29.0	N15 32.2	129 46.1	N 9 59.9	326 07.8	S 1 47.4
19	171 57.5	127 10.5	33.6	130 29.6	32.8	144 48.1	10 00.1	341 10.4	47.4
20	187 00.0	142 10.0	34.6	145 30.3	33.4	159 50.0	00.3	356 12.9	47.4
21	202 02.5	157 09.4	35.5	160 30.9	34.0	174 52.0	00.5	11 15.4	47.4
22	217 04.9	172 08.9	36.4	175 31.6	34.5	189 54.0	00.7	26 17.9	47.4
23	232 07.4	187 08.4	37.3	190 32.2	35.1	204 55.9	00.9	41 20.5	47.4
30 00	247 09.9	202 07.8	N15 38.2	205 32.9	N15 35.7	219 57.9	N10 01.1	56 23.0	S 1 47.3
01	262 12.3	217 07.3	39.1	220 33.5	36.3	234 59.8	01.2	71 25.5	47.3
02	277 14.8	232 06.7	40.0	235 34.2	36.8	250 01.8	01.4	86 28.0	47.3
03	292 17.3	247 06.2	41.0	250 34.8	37.4	265 03.8	01.6	101 30.5	47.3
04	307 19.7	262 05.6	41.9	265 35.5	38.0	280 05.7	01.8	116 33.1	47.3
05	322 22.2	277 05.1	42.8	280 36.1	38.5	295 07.7	02.0	131 35.6	47.3
06	337 24.7	292 04.5	N15 43.7	295 36.7	N15 39.1	310 09.6	N10 02.2	146 38.1	S 1 47.3
07	352 27.1	307 04.0	44.6	310 37.4	39.7	325 11.6	02.3	161 40.6	47.2
08	7 29.6	322 03.4	45.5	325 38.0	40.3	340 13.6	02.5	176 43.2	47.2
M 09	22 32.0	337 02.9	46.4	340 38.7	40.8	355 15.5	02.7	191 45.7	47.2
O 10	37 34.5	352 02.3	47.3	355 39.3	41.4	10 17.5	02.9	206 48.2	47.2
N 11	52 37.0	7 01.8	48.3	10 40.0	42.0	25 19.4	03.1	221 50.7	47.2
D 12	67 39.4	22 01.2	N15 49.2	25 40.6	N15 42.5	40 21.4	N10 03.3	236 53.2	S 1 47.2
A 13	82 41.9	37 00.7	50.1	40 41.3	43.1	55 23.4	03.4	251 55.8	47.2
Y 14	97 44.4	52 00.1	51.0	55 41.9	43.7	70 25.3	03.6	266 58.3	47.2
15	112 46.8	66 59.6	51.9	70 42.6	44.2	85 27.3	03.8	282 00.8	47.1
16	127 49.3	81 59.0	52.8	85 43.2	44.8	100 29.2	04.0	297 03.3	47.1
17	142 51.8	96 58.5	53.7	100 43.8	45.4	115 31.2	04.2	312 05.8	47.1
18	157 54.2	111 57.9	N15 54.6	115 44.5	N15 46.0	130 33.2	N10 04.4	327 08.4	S 1 47.1
19	172 56.7	126 57.3	55.5	130 45.1	46.5	145 35.1	04.5	342 10.9	47.1
20	187 59.2	141 56.8	56.4	145 45.8	47.1	160 37.1	04.7	357 13.4	47.1
21	203 01.6	156 56.2	57.3	160 46.4	47.7	175 39.0	04.9	12 15.9	47.1
22	218 04.1	171 55.7	58.2	175 47.1	48.2	190 41.0	05.1	27 18.4	47.0
23	233 06.5	186 55.1	59.1	190 47.7	48.8	205 43.0	05.3	42 20.9	47.0
	h m								
Mer. Pass.	7 34.0	v −0.5	d 0.9	v 0.6	d 0.6	v 2.0	d 0.2	v 2.5	d 0.0

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.5
Achernar	335 28.2	S57 10.5
Acrux	173 10.7	S63 10.1
Adhara	255 14.0	S28 59.5
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.6	N55 54.0
Alkaid	152 59.6	N49 15.4
Al Na'ir	27 45.5	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.6
Alpheratz	357 45.2	N29 09.1
Altair	62 09.4	N 8 53.9
Ankaa	353 17.3	S42 14.4
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.3
Atria	107 30.3	S69 02.8
Avior	234 19.0	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.3	S52 42.3
Capella	280 37.1	N46 00.5
Deneb	49 32.3	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.5	S17 55.3
Dubhe	193 53.3	N61 41.5
Elnath	278 14.9	N28 37.0
Eltanin	90 46.3	N51 29.2
Enif	33 48.5	N 9 55.7
Fomalhaut	15 25.6	S29 33.5
Gacrux	172 02.3	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.5	S60 25.9
Hamal	328 02.7	N23 30.9
Kaus Aust.	83 45.4	S34 22.6
Kochab	137 18.7	N74 06.6
Markab	13 39.9	N15 16.0
Menkar	314 16.9	N 4 08.0
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.4	S69 46.3
Mirfak	308 43.0	N49 54.0
Nunki	75 59.8	S26 16.8
Peacock	53 21.2	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.5	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.1
Sabik	102 13.9	S15 44.3
Schedar	349 42.6	N56 35.8
Shaula	96 23.5	S37 06.6
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.7	S43 29.1
Vega	80 39.6	N38 47.6
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	316 10.1	10 31
Mars	319 06.6	10 18
Jupiter	333 00.2	9 22
Saturn	169 11.7	20 15

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
28 00	180 42.3	N21 22.1	236 31.8	15.6	N 9 10.2	10.9	54.2
01	195 42.3	22.5	251 06.4	15.5	9 21.1	10.8	54.2
02	210 42.2	22.9	265 40.9	15.5	9 31.9	10.9	54.2
03	225 42.1	23.3	280 15.4	15.5	9 42.8	10.8	54.2
04	240 42.0	23.7	294 49.9	15.4	9 53.6	10.7	54.2
05	255 42.0	24.1	309 24.3	15.4	10 04.3	10.7	54.2
06	270 41.9	N21 24.5	323 58.7	15.3	N10 15.0	10.7	54.2
07	285 41.8	24.9	338 33.0	15.3	10 25.7	10.7	54.2
S 08	300 41.7	25.3	353 07.3	15.3	10 36.4	10.6	54.2
A 09	315 41.7	25.7	7 41.6	15.2	10 47.0	10.5	54.2
T 10	330 41.6	26.1	22 15.8	15.2	10 57.5	10.6	54.2
U 11	345 41.5	26.5	36 50.0	15.1	11 08.1	10.4	54.2
R 12	0 41.4	N21 26.9	51 24.1	15.1	N11 18.5	10.5	54.2
D 13	15 41.3	27.3	65 58.2	15.0	11 29.0	10.4	54.2
A 14	30 41.3	27.7	80 32.2	15.0	11 39.4	10.3	54.2
Y 15	45 41.2	28.2	95 06.2	15.0	11 49.7	10.4	54.2
16	60 41.1	28.6	109 40.2	14.9	12 00.1	10.2	54.3
17	75 41.0	29.0	124 14.1	14.9	12 10.3	10.2	54.3
18	90 41.0	N21 29.4	138 48.0	14.8	N12 20.5	10.2	54.3
19	105 40.9	29.8	153 21.8	14.7	12 30.7	10.2	54.3
20	120 40.8	30.1	167 55.5	14.7	12 40.9	10.0	54.3
21	135 40.7	30.5	182 29.2	14.7	12 50.9	10.1	54.3
22	150 40.6	30.9	197 02.9	14.6	13 01.0	10.0	54.3
23	165 40.6	31.3	211 36.5	14.6	13 11.0	9.9	54.3
29 00	180 40.5	N21 31.7	226 10.1	14.5	N13 20.9	9.9	54.3
01	195 40.4	32.1	240 43.6	14.4	13 30.8	9.8	54.3
02	210 40.3	32.5	255 17.0	14.4	13 40.6	9.8	54.3
03	225 40.2	32.9	269 50.4	14.4	13 50.4	9.7	54.4
04	240 40.2	33.3	284 23.8	14.3	14 00.1	9.7	54.4
05	255 40.1	33.7	298 57.1	14.2	14 09.8	9.6	54.4
06	270 40.0	N21 34.1	313 30.3	14.2	N14 19.4	9.6	54.4
07	285 39.9	34.5	328 03.5	14.1	14 29.0	9.5	54.4
08	300 39.8	34.9	342 36.6	14.1	14 38.5	9.5	54.4
S 09	315 39.7	35.3	357 09.7	14.0	14 48.0	9.4	54.4
U 10	330 39.7	35.7	11 42.7	14.0	14 57.4	9.3	54.4
N 11	345 39.6	36.1	26 15.7	13.9	15 06.7	9.3	54.4
D 12	0 39.5	N21 36.4	40 48.6	13.8	N15 16.0	9.2	54.5
A 13	15 39.4	36.8	55 21.4	13.8	15 25.2	9.1	54.5
Y 14	30 39.3	37.2	69 54.2	13.7	15 34.3	9.1	54.5
15	45 39.3	37.6	84 26.9	13.7	15 43.4	9.1	54.5
16	60 39.2	38.0	98 59.6	13.6	15 52.5	8.9	54.5
17	75 39.1	38.4	113 32.2	13.5	16 01.4	9.0	54.5
18	90 39.0	N21 38.8	128 04.7	13.5	N16 10.4	8.8	54.5
19	105 38.9	39.1	142 37.2	13.4	16 19.2	8.8	54.5
20	120 38.8	39.5	157 09.6	13.4	16 28.0	8.7	54.6
21	135 38.7	39.9	171 42.0	13.2	16 36.7	8.6	54.6
22	150 38.7	40.3	186 14.2	13.3	16 45.3	8.6	54.6
23	165 38.6	40.7	200 46.5	13.1	16 53.9	8.5	54.6
30 00	180 38.5	N21 41.0	215 18.6	13.1	N17 02.4	8.4	54.6
01	195 38.4	41.4	229 50.7	13.1	17 10.8	8.4	54.6
02	210 38.3	41.8	244 22.8	13.0	17 19.2	8.3	54.6
03	225 38.2	42.2	258 54.8	12.9	17 27.5	8.2	54.6
04	240 38.2	42.6	273 26.7	12.8	17 35.7	8.1	54.7
05	255 38.1	42.9	287 58.5	12.8	17 43.8	8.1	54.7
06	270 38.0	N21 43.3	302 30.3	12.7	N17 51.9	8.0	54.7
07	285 37.9	43.7	317 02.0	12.6	17 59.9	7.9	54.7
08	300 37.8	44.1	331 33.6	12.6	18 07.8	7.9	54.7
M 09	315 37.7	44.4	346 05.2	12.5	18 15.7	7.7	54.7
O 10	330 37.6	44.8	0 36.7	12.5	18 23.4	7.7	54.8
N 11	345 37.6	45.2	15 08.2	12.4	18 31.1	7.6	54.8
D 12	0 37.5	N21 45.6	29 39.6	12.3	N18 38.7	7.5	54.8
A 13	15 37.4	45.9	44 10.9	12.2	18 46.2	7.5	54.8
Y 14	30 37.3	46.3	58 42.1	12.2	18 53.7	7.3	54.8
15	45 37.2	46.7	73 13.3	12.1	19 01.0	7.3	54.8
16	60 37.1	47.0	87 44.4	12.1	19 08.3	7.2	54.8
17	75 37.0	47.4	102 15.5	12.0	19 15.5	7.1	54.9
18	90 36.9	N21 47.8	116 46.5	11.9	N19 22.6	7.0	54.9
19	105 36.8	48.1	131 17.4	11.8	19 29.6	7.0	54.9
20	120 36.8	48.5	145 48.2	11.8	19 36.6	6.8	54.9
21	135 36.7	48.9	160 19.0	11.7	19 43.4	6.8	54.9
22	150 36.6	49.2	174 49.7	11.7	19 50.2	6.7	55.0
23	165 36.5	49.6	189 20.4	11.6	N19 56.9	6.5	55.0
	SD 15.8	d 0.4	SD 14.8		14.8		14.9

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 28	Moonrise 29	Moonrise 30	Moonrise 31
	h m	h m	h m	h m	h m	h m	h m
N 72				{00 / 23 16 / 50}	23 03		
N 70				00 29	{00 / 23 14 / 52}	22 53	
68				00 41	00 33	00 23	00 09
66	////	////	01 27	00 50	00 48	00 46	00 46
64	////	////	02 07	00 58	01 00	01 04	01 13
62	////	00 41	02 34	01 04	01 11	01 20	01 33
60	////	01 36	02 55	01 10	01 20	01 32	01 50
N 58	////	02 07	03 12	01 15	01 28	01 43	02 05
56	00 37	02 30	03 26	01 20	01 35	01 53	02 17
54	01 28	02 48	03 38	01 24	01 41	02 02	02 28
52	01 56	03 03	03 49	01 28	01 47	02 09	02 37
50	02 18	03 17	03 59	01 31	01 52	02 16	02 46
45	02 56	03 43	04 19	01 39	02 03	02 31	03 04
N 40	03 23	04 03	04 35	01 45	02 12	02 43	03 19
35	03 44	04 20	04 49	01 51	02 21	02 54	03 32
30	04 01	04 33	05 00	01 55	02 28	03 03	03 43
20	04 28	04 56	05 20	02 04	02 40	03 19	04 02
N 10	04 48	05 15	05 38	02 11	02 51	03 33	04 18
0	05 06	05 32	05 54	02 18	03 01	03 46	04 34
S 10	05 21	05 47	06 10	02 25	03 11	03 59	04 50
20	05 36	06 03	06 27	02 33	03 22	04 14	05 07
30	05 50	06 20	06 46	02 41	03 35	04 30	05 26
35	05 58	06 29	06 57	02 46	03 42	04 40	05 37
40	06 06	06 40	07 10	02 52	03 51	04 51	05 51
45	06 15	06 52	07 25	02 59	04 01	05 03	06 06
S 50	06 26	07 06	07 44	03 07	04 13	05 19	06 25
52	06 30	07 13	07 52	03 11	04 18	05 27	06 34
54	06 35	07 20	08 02	03 15	04 25	05 35	06 45
56	06 40	07 28	08 13	03 19	04 31	05 44	06 56
58	06 46	07 37	08 26	03 24	04 39	05 55	07 10
S 60	06 52	07 47	08 41	03 30	04 48	06 07	07 25

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 28	Moonset 29	Moonset 30	Moonset 31
°	h m	h m	h m	h m	h m	h m	h m
N 72				17 30	19 49		
N 70				17 08	19 02	21 38	
68				16 50	18 32	20 24	
66	22 32	////	////	16 37	18 10	19 47	21 26
64	21 50	////	////	16 25	17 52	19 21	20 48
62	21 23	23 21	////	16 16	17 38	19 01	20 21
60	21 01	22 21	////	16 07	17 26	18 44	20 00
N 58	20 44	21 49	////	16 00	17 15	18 30	19 43
56	20 30	21 26	23 24	15 54	17 06	18 19	19 29
54	20 17	21 08	22 30	15 48	16 58	18 08	19 16
52	20 06	20 52	22 00	15 43	16 51	17 59	19 05
50	19 57	20 39	21 38	15 38	16 45	17 51	18 56
45	19 37	20 13	21 00	15 29	16 31	17 34	18 35
N 40	19 20	19 52	20 32	15 20	16 19	17 19	18 19
35	19 07	19 36	20 11	15 13	16 10	17 07	18 05
30	18 55	19 22	19 54	15 07	16 01	16 57	17 53
20	18 34	18 59	19 27	14 57	15 47	16 39	17 33
N 10	18 17	18 40	19 07	14 47	15 34	16 23	17 15
0	18 01	18 23	18 49	14 39	15 22	16 09	16 58
S 10	17 45	18 08	18 34	14 30	15 11	15 54	16 41
20	17 28	17 52	18 19	14 21	14 58	15 39	16 24
30	17 09	17 35	18 04	14 10	14 44	15 21	16 03
35	16 57	17 25	17 56	14 04	14 36	15 11	15 51
40	16 45	17 14	17 48	13 57	14 26	14 59	15 38
45	16 29	17 02	17 39	13 50	14 15	14 46	15 22
S 50	16 11	16 48	17 29	13 40	14 02	14 29	15 02
52	16 02	16 42	17 24	13 36	13 56	14 21	14 52
54	15 52	16 34	17 19	13 31	13 49	14 12	14 42
56	15 41	16 26	17 14	13 26	13 42	14 02	14 30
58	15 28	16 17	17 08	13 20	13 33	13 51	14 16
S 60	15 14	16 07	17 02	13 13	13 24	13 38	14 00

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
28	02 50	02 46	11 57	08 28	20 50	25	18
29	02 42	02 38	11 57	09 12	21 34	26	11
30	02 34	02 30	11 57	09 57	22 21	27	6

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
31 00	248 09.0	201 54.6	N16 00.0	205 48.4	N15 49.4	220 44.9	N10 05.5	57 23.5	S 1 47.0
01	263 11.5	216 54.0	00.9	220 49.0	49.9	235 46.9	05.6	72 26.0	47.0
02	278 13.9	231 53.4	01.8	235 49.6	50.5	250 48.8	05.8	87 28.5	47.0
03	293 16.4	246 52.9	02.7	250 50.3	51.0	265 50.8	06.0	102 31.0	47.0
04	308 18.9	261 52.3	03.6	265 50.9	51.6	280 52.8	06.2	117 33.5	47.0
05	323 21.3	276 51.8	04.5	280 51.6	52.2	295 54.7	06.4	132 36.1	47.0
06	338 23.8	291 51.2	N16 05.4	295 52.2	N15 52.7	310 56.7	N10 06.5	147 38.6	S 1 46.9
07	353 26.3	306 50.6	06.3	310 52.9	53.3	325 58.7	06.7	162 41.1	46.9
08	8 28.7	321 50.1	07.2	325 53.5	53.9	341 00.6	06.9	177 43.6	46.9
09	23 31.2	336 49.5	08.1	340 54.2	54.4	356 02.6	07.1	192 46.1	46.9
10	38 33.6	351 49.0	09.0	355 54.8	55.0	11 04.5	07.3	207 48.6	46.9
11	53 36.1	6 48.4	09.9	10 55.4	55.6	26 06.5	07.5	222 51.2	46.9
12	68 38.6	21 47.8	N16 10.8	25 56.1	N15 56.1	41 08.5	N10 07.6	237 53.7	S 1 46.9
13	83 41.0	36 47.3	11.7	40 56.7	56.7	56 10.4	07.8	252 56.2	46.9
14	98 43.5	51 46.7	12.5	55 57.4	57.2	71 12.4	08.0	267 58.7	46.9
15	113 46.0	66 46.1	13.4	70 58.0	57.8	86 14.4	08.2	283 01.2	46.8
16	128 48.4	81 45.6	14.3	85 58.7	58.4	101 16.3	08.4	298 03.7	46.8
17	143 50.9	96 45.0	15.2	100 59.3	58.9	116 18.3	08.5	313 06.3	46.8
18	158 53.4	111 44.4	N16 16.1	115 59.9	N15 59.5	131 20.2	N10 08.7	328 08.8	S 1 46.8
19	173 55.8	126 43.9	17.0	131 00.6	16 00.1	146 22.2	08.9	343 11.3	46.8
20	188 58.3	141 43.3	17.9	146 01.2	00.6	161 24.2	09.1	358 13.8	46.8
21	204 00.8	156 42.7	18.8	161 01.9	01.2	176 26.1	09.3	13 16.3	46.8
22	219 03.2	171 42.2	19.6	176 02.5	01.7	191 28.1	09.5	28 18.8	46.8
23	234 05.7	186 41.6	20.5	191 03.2	02.3	206 30.1	09.6	43 21.3	46.7
1 00	249 08.1	201 41.0	N16 21.4	206 03.8	N16 02.9	221 32.0	N10 09.8	58 23.9	S 1 46.7
01	264 10.6	216 40.5	22.3	221 04.4	03.4	236 34.0	10.0	73 26.4	46.7
02	279 13.1	231 39.9	23.2	236 05.1	04.0	251 36.0	10.2	88 28.9	46.7
03	294 15.5	246 39.3	24.1	251 05.7	04.5	266 37.9	10.4	103 31.4	46.7
04	309 18.0	261 38.8	24.9	266 06.4	05.1	281 39.9	10.5	118 33.9	46.7
05	324 20.5	276 38.2	25.8	281 07.0	05.6	296 41.8	10.7	133 36.4	46.7
06	339 22.9	291 37.6	N16 26.7	296 07.7	N16 06.2	311 43.8	N10 10.9	148 38.9	S 1 46.7
07	354 25.4	306 37.1	27.6	311 08.3	06.8	326 45.8	11.1	163 41.5	46.7
08	9 27.9	321 36.5	28.5	326 08.9	07.3	341 47.7	11.3	178 44.0	46.7
09	24 30.3	336 35.9	29.3	341 09.6	07.9	356 49.7	11.4	193 46.5	46.6
10	39 32.8	351 35.3	30.2	356 10.2	08.4	11 51.7	11.6	208 49.0	46.6
11	54 35.3	6 34.8	31.1	11 10.9	09.0	26 53.6	11.8	223 51.5	46.6
12	69 37.7	21 34.2	N16 32.0	26 11.5	N16 09.5	41 55.6	N10 12.0	238 54.0	S 1 46.6
13	84 40.2	36 33.6	32.8	41 12.1	10.1	56 57.6	12.2	253 56.5	46.6
14	99 42.6	51 33.0	33.7	56 12.8	10.7	71 59.5	12.4	268 59.0	46.6
15	114 45.1	66 32.5	34.6	71 13.4	11.2	87 01.5	12.5	284 01.6	46.6
16	129 47.6	81 31.9	35.5	86 14.1	11.8	102 03.5	12.7	299 04.1	46.6
17	144 50.0	96 31.3	36.3	101 14.7	12.3	117 05.4	12.9	314 06.6	46.6
18	159 52.5	111 30.7	N16 37.2	116 15.3	N16 12.9	132 07.4	N10 13.1	329 09.1	S 1 46.6
19	174 55.0	126 30.2	38.1	131 16.0	13.4	147 09.4	13.3	344 11.6	46.5
20	189 57.4	141 29.6	38.9	146 16.6	14.0	162 11.3	13.4	359 14.1	46.5
21	204 59.9	156 29.0	39.8	161 17.3	14.5	177 13.3	13.6	14 16.6	46.5
22	220 02.4	171 28.4	40.7	176 17.9	15.1	192 15.3	13.8	29 19.1	46.5
23	235 04.8	186 27.8	41.5	191 18.6	15.6	207 17.2	14.0	44 21.7	46.5
2 00	250 07.3	201 27.3	N16 42.4	206 19.2	N16 16.2	222 19.2	N10 14.2	59 24.2	S 1 46.5
01	265 09.8	216 26.7	43.3	221 19.8	16.7	237 21.2	14.3	74 26.7	46.5
02	280 12.2	231 26.1	44.1	236 20.5	17.3	252 23.1	14.5	89 29.2	46.5
03	295 14.7	246 25.5	45.0	251 21.1	17.8	267 25.1	14.7	104 31.7	46.5
04	310 17.1	261 24.9	45.9	266 21.8	18.4	282 27.1	14.9	119 34.2	46.5
05	325 19.6	276 24.4	46.7	281 22.4	18.9	297 29.0	15.0	134 36.7	46.4
06	340 22.1	291 23.8	N16 47.6	296 23.0	N16 19.5	312 31.0	N10 15.2	149 39.2	S 1 46.4
07	355 24.5	306 23.2	48.5	311 23.7	20.0	327 33.0	15.4	164 41.7	46.4
08	10 27.0	321 22.6	49.3	326 24.3	20.6	342 34.9	15.6	179 44.2	46.4
09	25 29.5	336 22.0	50.2	341 25.0	21.1	357 36.9	15.8	194 46.8	46.4
10	40 31.9	351 21.4	51.0	356 25.6	21.7	12 38.9	15.9	209 49.3	46.4
11	55 34.4	6 20.8	51.9	11 26.2	22.2	27 40.8	16.1	224 51.8	46.4
12	70 36.9	21 20.3	N16 52.8	26 26.9	N16 22.8	42 42.8	N10 16.3	239 54.3	S 1 46.4
13	85 39.3	36 19.7	53.6	41 27.5	23.3	57 44.8	16.5	254 56.8	46.4
14	100 41.8	51 19.1	54.5	56 28.2	23.9	72 46.7	16.7	269 59.3	46.4
15	115 44.3	66 18.5	55.3	71 28.8	24.4	87 48.7	16.8	285 01.8	46.4
16	130 46.7	81 17.9	56.2	86 29.4	25.0	102 50.7	17.0	300 04.3	46.4
17	145 49.2	96 17.3	57.0	101 30.1	25.5	117 52.6	17.2	315 06.8	46.3
18	160 51.6	111 16.7	N16 57.9	116 30.7	N16 26.1	132 54.6	N10 17.4	330 09.3	S 1 46.3
19	175 54.1	126 16.1	58.8	131 31.4	26.6	147 56.6	17.6	345 11.8	46.3
20	190 56.6	141 15.6	16 59.6	146 32.0	27.2	162 58.5	17.7	0 14.4	46.3
21	205 59.0	156 15.0	17 00.5	161 32.6	27.7	178 00.5	17.9	15 16.9	46.3
22	221 01.5	171 14.4	01.3	176 33.3	28.3	193 02.5	18.1	30 19.4	46.3
23	236 04.0	186 13.8	02.2	191 33.9	28.8	208 04.4	18.3	45 21.9	46.3
	h m								
Mer. Pass.	7 22.2	v −0.6	d 0.9	v 0.6	d 0.6	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.4
Achernar	335 28.2	S57 10.5
Acrux	173 10.7	S63 10.1
Adhara	255 14.0	S28 59.5
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.6	N55 54.0
Alkaid	152 59.6	N49 15.5
Al Na'ir	27 45.4	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.6	S 8 42.7
Alphecca	126 11.9	N26 40.6
Alpheratz	357 45.2	N29 09.1
Altair	62 09.4	N 8 53.9
Ankaa	353 17.3	S42 14.4
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.3	S69 02.8
Avior	234 19.1	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.4
Canopus	263 57.3	S52 42.3
Capella	280 37.1	N46 00.5
Deneb	49 32.3	N45 19.1
Denebola	182 35.0	N14 30.4
Diphda	348 57.5	S17 55.3
Dubhe	193 53.3	N61 41.5
Elnath	278 14.9	N28 36.9
Eltanin	90 46.3	N51 29.2
Enif	33 48.5	N 9 55.7
Fomalhaut	15 25.6	S29 33.5
Gacrux	172 02.3	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.5	S60 25.9
Hamal	328 02.7	N23 30.9
Kaus Aust.	83 45.4	S34 22.6
Kochab	137 18.8	N74 06.6
Markab	13 39.8	N15 16.0
Menkar	314 16.9	N 4 08.0
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.5	S69 46.3
Mirfak	308 43.0	N49 54.0
Nunki	75 59.8	S26 16.8
Peacock	53 21.1	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.5	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.1
Sabik	102 13.9	S15 44.3
Schedar	349 42.6	N56 35.8
Shaula	96 23.5	S37 06.7
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.7	S43 29.1
Vega	80 39.6	N38 47.6
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	312 32.9	10 34
Mars	316 55.6	10 15
Jupiter	332 23.9	9 13
Saturn	169 15.7	20 03

TUESDAY

WEDNESDAY

THURSDAY

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
31 00	180 36.4	N21 50.0	203 51.0	11.5	N20 03.4	6.5	55.0
01	195 36.3	50.3	218 21.5	11.4	20 09.9	6.4	55.0
02	210 36.2	50.7	232 51.9	11.4	20 16.3	6.3	55.0
03	225 36.1	. . 51.1	247 22.3	11.3	20 22.6	6.2	55.0
04	240 36.0	51.4	261 52.6	11.3	20 28.8	6.2	55.1
05	255 36.0	51.8	276 22.9	11.2	20 35.0	6.0	55.1
06	270 35.9	N21 52.2	290 53.1	11.1	N20 41.0	5.9	55.1
07	285 35.8	52.5	305 23.2	11.1	20 46.9	5.8	55.1
T 08	300 35.7	52.9	319 53.3	11.0	20 52.7	5.8	55.1
U 09	315 35.6	. . 53.2	334 23.3	10.9	20 58.5	5.6	55.1
E 10	330 35.5	53.6	348 53.2	10.9	21 04.1	5.5	55.2
S 11	345 35.4	53.9	3 23.1	10.8	21 09.6	5.5	55.2
D 12	0 35.3	N21 54.3	17 52.9	10.7	N21 15.1	5.3	55.2
A 13	15 35.2	54.7	32 22.6	10.7	21 20.4	5.2	55.2
Y 14	30 35.1	55.0	46 52.3	10.6	21 25.6	5.1	55.2
15	45 35.0	. . 55.4	61 21.9	10.5	21 30.7	5.1	55.3
16	60 34.9	55.7	75 51.4	10.5	21 35.8	4.9	55.3
17	75 34.9	56.1	90 20.9	10.4	21 40.7	4.8	55.3
18	90 34.8	N21 56.4	104 50.3	10.4	N21 45.5	4.7	55.3
19	105 34.7	56.8	119 19.7	10.3	21 50.2	4.6	55.3
20	120 34.6	57.1	133 49.0	10.3	21 54.8	4.5	55.4
21	135 34.5	. . 57.5	148 18.3	10.1	21 59.3	4.4	55.4
22	150 34.4	57.8	162 47.4	10.2	22 03.7	4.2	55.4
23	165 34.3	58.2	177 16.6	10.0	22 07.9	4.2	55.4
1 00	180 34.2	N21 58.5	191 45.6	10.0	N22 12.1	4.1	55.4
01	195 34.1	58.9	206 14.6	10.0	22 16.2	3.9	55.5
02	210 34.0	59.2	220 43.6	9.9	22 20.1	3.8	55.5
03	225 33.9	. . 59.6	235 12.5	9.8	22 23.9	3.7	55.5
04	240 33.8	21 59.9	249 41.3	9.8	22 27.6	3.6	55.5
05	255 33.7	22 00.3	264 10.1	9.8	22 31.2	3.5	55.5
06	270 33.6	N22 00.6	278 38.9	9.6	N22 34.7	3.4	55.6
W 07	285 33.5	01.0	293 07.5	9.7	22 38.1	3.3	55.6
E 08	300 33.4	01.3	307 36.2	9.5	22 41.4	3.1	55.6
D 09	315 33.4	. . 01.6	322 04.7	9.6	22 44.5	3.0	55.6
N 10	330 33.3	02.0	336 33.3	9.4	22 47.5	2.9	55.6
E 11	345 33.2	02.3	351 01.7	9.5	22 50.4	2.8	55.7
S 12	0 33.1	N22 02.7	5 30.2	9.3	N22 53.2	2.7	55.7
D 13	15 33.0	03.0	19 58.5	9.4	22 55.9	2.5	55.7
A 14	30 32.9	03.3	34 26.9	9.3	22 58.4	2.5	55.7
Y 15	45 32.8	. . 03.7	48 55.2	9.2	23 00.9	2.3	55.7
16	60 32.7	04.0	63 23.4	9.2	23 03.2	2.2	55.8
17	75 32.6	04.4	77 51.6	9.1	N23 05.4	2.0	55.8
18	90 32.5	N22 04.7					
19	105 32.4	05.0	A partial eclipse of the Sun occurs on this date. See page 5.				
20	120 32.3	05.4					
21	135 32.2	. . 05.7					
22	150 32.1	06.0					
23	165 32.0	06.4					
2 00	180 31.9	N22 06.7	179 07.8	8.8	N23 17.2	1.2	55.9
01	195 31.8	07.0	193 35.6	8.9	23 18.4	1.1	55.9
02	210 31.7	07.4	208 03.5	8.8	23 19.5	0.9	56.0
03	225 31.6	. . 07.7	222 31.3	8.7	23 20.4	0.9	56.0
04	240 31.5	08.0	236 59.0	8.8	23 21.3	0.7	56.0
05	255 31.4	08.4	251 26.8	8.7	23 22.0	0.5	56.0
06	270 31.3	N22 08.7	265 54.5	8.6	N23 22.5	0.4	56.1
T 07	285 31.2	09.0	280 22.1	8.7	23 22.9	0.4	56.1
H 08	300 31.1	09.3	294 49.8	8.6	23 23.3	0.1	56.1
U 09	315 31.0	. . 09.7	309 17.4	8.6	23 23.4	0.1	56.1
R 10	330 30.9	10.0	323 45.0	8.6	23 23.5	0.1	56.1
S 11	345 30.8	10.3	338 12.6	8.5	23 23.4	0.2	56.2
D 12	0 30.7	N22 10.6	352 40.1	8.5	N23 23.2	0.3	56.2
A 13	15 30.6	11.0	7 07.6	8.5	23 22.9	0.5	56.2
Y 14	30 30.5	11.3	21 35.1	8.5	23 22.4	0.6	56.2
15	45 30.4	. . 11.6	36 02.6	8.4	23 21.8	0.7	56.2
16	60 30.3	11.9	50 30.0	8.4	23 21.1	0.9	56.3
17	75 30.2	12.3	64 57.4	8.5	23 20.2	1.0	56.3
18	90 30.1	N22 12.6	79 24.9	8.4	N23 19.2	1.1	56.3
19	105 30.0	12.9	93 52.3	8.3	23 18.1	1.3	56.3
20	120 29.9	13.2	108 19.6	8.4	23 16.8	1.3	56.4
21	135 29.8	. . 13.5	122 47.0	8.4	23 15.5	1.6	56.4
22	150 29.7	13.8	137 14.4	8.3	23 13.9	1.6	56.4
23	165 29.6	14.2	151 41.7	8.3	N23 12.3	1.8	56.4
	SD 15.8	d 0.3	SD	15.0		15.2	15.3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 31	Moonrise 1	Moonrise 2	Moonrise 3
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70							
68				00 09			
66	////	////	01 14	00 46	00 50	01 09	02 11
64	////	////	01 59	01 13	01 29	02 02	03 01
62	////	00 08	02 28	01 33	01 56	02 34	03 32
60	////	01 27	02 50	01 50	02 17	02 58	03 56
N 58	////	02 01	03 08	02 05	02 35	03 17	04 15
56	00 07	02 25	03 22	02 17	02 49	03 33	04 30
54	01 19	02 44	03 35	02 28	03 02	03 47	04 44
52	01 51	03 00	03 46	02 37	03 13	03 59	04 56
50	02 13	03 14	03 56	02 46	03 23	04 09	05 06
45	02 53	03 41	04 17	03 04	03 44	04 32	05 28
N 40	03 21	04 01	04 33	03 19	04 01	04 50	05 45
35	03 42	04 18	04 47	03 32	04 15	05 05	06 00
30	04 00	04 32	04 59	03 43	04 27	05 18	06 13
20	04 27	04 56	05 20	04 02	04 49	05 40	06 35
N 10	04 48	05 15	05 38	04 18	05 07	05 59	06 54
0	05 06	05 32	05 54	04 34	05 25	06 17	07 12
S 10	05 22	05 48	06 10	04 50	05 42	06 36	07 29
20	05 37	06 04	06 28	05 07	06 01	06 55	07 48
30	05 52	06 21	06 47	05 26	06 22	07 18	08 10
35	06 00	06 31	06 59	05 37	06 35	07 31	08 23
40	06 08	06 42	07 12	05 51	06 50	07 46	08 38
45	06 18	06 54	07 28	06 06	07 07	08 04	08 55
S 50	06 28	07 09	07 47	06 25	07 29	08 27	09 17
52	06 33	07 16	07 56	06 34	07 39	08 37	09 27
54	06 38	07 23	08 06	06 45	07 51	08 50	09 39
56	06 44	07 32	08 17	06 56	08 04	09 04	09 52
58	06 50	07 41	08 30	07 10	08 20	09 20	10 07
S 60	06 56	07 51	08 46	07 25	08 38	09 40	10 26

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 31	Moonset 1	Moonset 2	Moonset 3
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70							
68							
66	22 46	////	////	21 26	22 56	23 47	24 01
64	21 59	////	////	20 48	22 04	22 57	23 26
62	21 29	////	////	20 21	21 32	22 25	23 00
60	21 07	22 31	////	20 00	21 08	22 02	22 40
N 58	20 49	21 56	////	19 43	20 49	21 43	22 23
56	20 34	21 32	////	19 29	20 33	21 27	22 09
54	20 21	21 12	22 39	19 16	20 19	21 13	21 57
52	20 10	20 56	22 06	19 05	20 07	21 01	21 46
50	20 00	20 43	21 43	18 56	19 57	20 51	21 37
45	19 39	20 16	21 03	18 35	19 35	20 29	21 16
N 40	19 22	19 55	20 35	18 19	19 17	20 11	21 00
35	19 08	19 38	20 14	18 05	19 02	19 56	20 46
30	18 56	19 23	19 56	17 53	18 49	19 43	20 34
20	18 36	19 00	19 29	17 33	18 27	19 21	20 13
N 10	18 18	18 41	19 08	17 15	18 08	19 01	19 55
0	18 01	18 24	18 50	16 58	17 50	18 43	19 38
S 10	17 45	18 08	18 34	16 41	17 32	18 25	19 21
20	17 28	17 52	18 19	16 24	17 13	18 06	19 02
30	17 08	17 34	18 04	16 03	16 51	17 43	18 41
35	16 56	17 24	17 56	15 51	16 38	17 30	18 28
40	16 43	17 13	17 47	15 38	16 23	17 15	18 14
45	16 28	17 01	17 38	15 22	16 05	16 57	17 57
S 50	16 09	16 46	17 27	15 02	15 43	16 35	17 36
52	16 00	16 39	17 22	14 52	15 33	16 24	17 26
54	15 49	16 32	17 17	14 42	15 21	16 12	17 14
56	15 38	16 24	17 12	14 30	15 07	15 58	17 01
58	15 25	16 14	17 06	14 16	14 52	15 41	16 46
S 60	15 09	16 04	16 59	14 00	14 33	15 21	16 28

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
31	02 26	02 21	11 58	10 46	23 11	28	2
1	02 17	02 12	11 58	11 37	24 04	29	0
2	02 08	02 03	11 58	12 30	00 04	01	0

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
3 00	251 06.4	201 13.2	N17 03.0	206 34.6	N16 29.4	223 06.4	N10 18.4	60 24.4	S 1 46.3
01	266 08.9	216 12.6	03.9	221 35.2	29.9	238 08.4	18.6	75 26.9	46.3
02	281 11.4	231 12.0	04.7	236 35.8	30.4	253 10.3	18.8	90 29.4	46.3
03	296 13.8	246 11.4 . .	05.6	251 36.5 . .	31.0	268 12.3 . .	19.0	105 31.9 . .	46.3
04	311 16.3	261 10.8	06.4	266 37.1	31.5	283 14.3	19.2	120 34.4	46.3
05	326 18.7	276 10.2	07.2	281 37.7	32.1	298 16.3	19.3	135 36.9	46.3
06	341 21.2	291 09.6	N17 08.1	296 38.4	N16 32.6	313 18.2	N10 19.5	150 39.4	S 1 46.2
07	356 23.7	306 09.0	08.9	311 39.0	33.2	328 20.2	19.7	165 41.9	46.2
08	11 26.1	321 08.5	09.8	326 39.7	33.7	343 22.2	19.9	180 44.4	46.2
F 09	26 28.6	336 07.9 . .	10.6	341 40.3 . .	34.3	358 24.1 . .	20.1	195 46.9 . .	46.2
R 10	41 31.1	351 07.3	11.5	356 40.9	34.8	13 26.1	20.2	210 49.4	46.2
I 11	56 33.5	6 06.7	12.3	11 41.6	35.3	28 28.1	20.4	225 51.9	46.2
D 12	71 36.0	21 06.1	N17 13.1	26 42.2	N16 35.9	43 30.0	N10 20.6	240 54.5	S 1 46.2
A 13	86 38.5	36 05.5	14.0	41 42.9	36.4	58 32.0	20.8	255 57.0	46.2
Y 14	101 40.9	51 04.9	14.8	56 43.5	37.0	73 34.0	20.9	270 59.5	46.2
15	116 43.4	66 04.3 . .	15.7	71 44.1 . .	37.5	88 36.0 . .	21.1	286 02.0 . .	46.2
16	131 45.9	81 03.7	16.5	86 44.8	38.0	103 37.9	21.3	301 04.5	46.2
17	146 48.3	96 03.1	17.3	101 45.4	38.6	118 39.9	21.5	316 07.0	46.2
18	161 50.8	111 02.5	N17 18.2	116 46.0	N16 39.1	133 41.9	N10 21.6	331 09.5	S 1 46.2
19	176 53.2	126 01.9	19.0	131 46.7	39.7	148 43.8	21.8	346 12.0	46.2
20	191 55.7	141 01.3	19.8	146 47.3	40.2	163 45.8	22.0	1 14.5	46.2
21	206 58.2	156 00.7 . .	20.7	161 48.0 . .	40.7	178 47.8 . .	22.2	16 17.0 . .	46.1
22	222 00.6	171 00.1	21.5	176 48.6	41.3	193 49.7	22.4	31 19.5	46.1
23	237 03.1	185 59.5	22.3	191 49.2	41.8	208 51.7	22.5	46 22.0	46.1
4 00	252 05.6	200 58.9	N17 23.2	206 49.9	N16 42.4	223 53.7	N10 22.7	61 24.5	S 1 46.1
01	267 08.0	215 58.3	24.0	221 50.5	42.9	238 55.7	22.9	76 27.0	46.1
02	282 10.5	230 57.7	24.8	236 51.1	43.4	253 57.6	23.1	91 29.5	46.1
03	297 13.0	245 57.1 . .	25.7	251 51.8 . .	44.0	268 59.6 . .	23.2	106 32.0 . .	46.1
04	312 15.4	260 56.4	26.5	266 52.4	44.5	284 01.6	23.4	121 34.5	46.1
05	327 17.9	275 55.8	27.3	281 53.0	45.0	299 03.6	23.6	136 37.0	46.1
06	342 20.4	290 55.2	N17 28.2	296 53.7	N16 45.6	314 05.5	N10 23.8	151 39.5	S 1 46.1
07	357 22.8	305 54.6	29.0	311 54.3	46.1	329 07.5	23.9	166 42.0	46.1
S 08	12 25.3	320 54.0	29.8	326 55.0	46.7	344 09.5	24.1	181 44.5	46.1
A 09	27 27.7	335 53.4 . .	30.6	341 55.6 . .	47.2	359 11.4 . .	24.3	196 47.0 . .	46.1
T 10	42 30.2	350 52.8	31.5	356 56.2	47.7	14 13.4	24.5	211 49.5	46.1
U 11	57 32.7	5 52.2	32.3	11 56.9	48.3	29 15.4	24.7	226 52.0	46.1
R 12	72 35.1	20 51.6	N17 33.1	26 57.5	N16 48.8	44 17.4	N10 24.8	241 54.5	S 1 46.1
D 13	87 37.6	35 51.0	33.9	41 58.1	49.3	59 19.3	25.0	256 57.0	46.1
A 14	102 40.1	50 50.4	34.7	56 58.8	49.9	74 21.3	25.2	271 59.5	46.1
Y 15	117 42.5	65 49.8 . .	35.6	71 59.4 . .	50.4	89 23.3 . .	25.4	287 02.0 . .	46.0
16	132 45.0	80 49.2	36.4	87 00.1	50.9	104 25.3	25.5	302 04.5	46.0
17	147 47.5	95 48.5	37.2	102 00.7	51.5	119 27.2	25.7	317 07.0	46.0
18	162 49.9	110 47.9	N17 38.0	117 01.3	N16 52.0	134 29.2	N10 25.9	332 09.5	S 1 46.0
19	177 52.4	125 47.3	38.8	132 02.0	52.5	149 31.2	26.1	347 12.0	46.0
20	192 54.9	140 46.7	39.7	147 02.6	53.1	164 33.1	26.2	2 14.5	46.0
21	207 57.3	155 46.1 . .	40.5	162 03.2 . .	53.6	179 35.1 . .	26.4	17 17.0 . .	46.0
22	222 59.8	170 45.5	41.3	177 03.9	54.1	194 37.1	26.6	32 19.5	46.0
23	238 02.2	185 44.9	42.1	192 04.5	54.7	209 39.1	26.8	47 22.0	46.0
5 00	253 04.7	200 44.3	N17 42.9	207 05.1	N16 55.2	224 41.0	N10 26.9	62 24.5	S 1 46.0
01	268 07.2	215 43.6	43.7	222 05.8	55.7	239 43.0	27.1	77 27.0	46.0
02	283 09.6	230 43.0	44.5	237 06.4	56.3	254 45.0	27.3	92 29.5	46.0
03	298 12.1	245 42.4 . .	45.3	252 07.0 . .	56.8	269 47.0 . .	27.5	107 32.0 . .	46.0
04	313 14.6	260 41.8	46.2	267 07.7	57.3	284 48.9	27.6	122 34.5	46.0
05	328 17.0	275 41.2	47.0	282 08.3	57.8	299 50.9	27.8	137 37.0	46.0
06	343 19.5	290 40.6	N17 47.8	297 08.9	N16 58.4	314 52.9	N10 28.0	152 39.5	S 1 46.0
07	358 22.0	305 39.9	48.6	312 09.6	58.9	329 54.9	28.2	167 42.0	46.0
08	13 24.4	320 39.3	49.4	327 10.2	16 59.4	344 56.8	28.3	182 44.5	46.0
S 09	28 26.9	335 38.7 . .	50.2	342 10.9	17 00.0	359 58.8 . .	28.5	197 47.0 . .	46.0
U 10	43 29.4	350 38.1	51.0	357 11.5	00.5	15 00.8	28.7	212 49.5	46.0
N 11	58 31.8	5 37.5	51.8	12 12.1	01.0	30 02.8	28.9	227 52.0	46.0
D 12	73 34.3	20 36.9	N17 52.6	27 12.8	N17 01.5	45 04.7	N10 29.0	242 54.5	S 1 46.0
A 13	88 36.7	35 36.2	53.4	42 13.4	02.1	60 06.7	29.2	257 57.0	46.0
Y 14	103 39.2	50 35.6	54.2	57 14.0	02.6	75 08.7	29.4	272 59.5	46.0
15	118 41.7	65 35.0 . .	55.0	72 14.7 . .	03.1	90 10.7 . .	29.6	288 02.0 . .	45.9
16	133 44.1	80 34.4	55.8	87 15.3	03.6	105 12.6	29.7	303 04.5	45.9
17	148 46.6	95 33.7	56.6	102 15.9	04.2	120 14.6	29.9	318 07.0	45.9
18	163 49.1	110 33.1	N17 57.4	117 16.6	N17 04.7	135 16.6	N10 30.1	333 09.5	S 1 45.9
19	178 51.5	125 32.5	58.2	132 17.2	05.2	150 18.6	30.3	348 12.0	45.9
20	193 54.0	140 31.9	59.0	147 17.8	05.7	165 20.6	30.4	3 14.5	45.9
21	208 56.5	155 31.3	17 59.8	162 18.5 . .	06.3	180 22.5 . .	30.6	18 17.0 . .	45.9
22	223 58.9	170 30.6	18 00.6	177 19.1	06.8	195 24.5	30.8	33 19.5	45.9
23	239 01.4	185 30.0	N18 01.4	192 19.7	07.3	210 26.5	31.0	48 22.0	45.9
Mer. Pass.	h m 7 10.5	v −0.6	d 0.8	v 0.6	d 0.5	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.4
Achernar	335 28.2	S57 10.5
Acrux	173 10.7	S63 10.1
Adhara	255 14.0	S28 59.5
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.6	N55 54.0
Alkaid	152 59.6	N49 15.5
Al Na'ir	27 45.4	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.6
Alpheratz	357 45.1	N29 09.1
Altair	62 09.4	N 8 53.9
Ankaa	353 17.2	S42 14.4
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.3	S69 02.9
Avior	234 19.1	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.5
Canopus	263 57.3	S52 42.3
Capella	280 37.1	N46 00.5
Deneb	49 32.2	N45 19.2
Denebola	182 35.1	N14 30.4
Diphda	348 57.5	S17 55.3
Dubhe	193 53.4	N61 41.5
Elnath	278 14.8	N28 36.9
Eltanin	90 46.3	N51 29.2
Enif	33 48.4	N 9 55.7
Fomalhaut	15 25.5	S29 33.4
Gacrux	172 02.4	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.5	S60 26.0
Hamal	328 02.7	N23 30.9
Kaus Aust.	83 45.3	S34 22.6
Kochab	137 18.8	N74 06.6
Markab	13 39.8	N15 16.0
Menkar	314 16.9	N 4 08.0
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.5	S69 46.3
Mirfak	308 42.9	N49 54.0
Nunki	75 59.8	S26 16.8
Peacock	53 21.1	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.5	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.1
Sabik	102 13.9	S15 44.3
Schedar	349 42.5	N56 35.8
Shaula	96 23.5	S37 06.7
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.8	S43 29.1
Vega	80 39.6	N38 47.6
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	308 53.3	10 37
Mars	314 44.3	10 12
Jupiter	331 48.1	9 03
Saturn	169 18.9	19 51

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
3 00	180 29.5	N22 14.5	166 09.0	8.4	N23 10.5	1.9	56.4
01	195 29.4	14.8	180 36.4	8.3	23 08.6	2.0	56.5
02	210 29.3	15.1	195 03.7	8.3	23 06.6	2.2	56.5
03	225 29.2	15.4	209 31.0	8.3	23 04.4	2.3	56.5
04	240 29.1	15.7	223 58.3	8.3	22 02.1	2.4	56.5
05	255 29.0	16.1	238 25.6	8.3	22 59.7	2.6	56.5
06	270 28.9	N22 16.4	252 52.9	8.3	N22 57.1	2.7	56.6
07	285 28.8	16.7	267 20.2	8.3	22 54.4	2.8	56.6
08	300 28.7	17.0	281 47.5	8.3	22 51.6	3.0	56.6
F 09	315 28.6	17.3	296 14.8	8.3	22 48.6	3.1	56.6
R 10	330 28.5	17.6	310 42.1	8.2	22 45.5	3.2	56.7
I 11	345 28.4	17.9	325 09.3	8.3	22 42.3	3.3	56.7
D 12	0 28.3	N22 18.2	339 36.6	8.3	N22 39.0	3.5	56.7
A 13	15 28.2	18.5	354 03.9	8.4	22 35.5	3.6	56.7
Y 14	30 28.1	18.8	8 31.3	8.3	22 31.9	3.8	56.7
15	45 28.0	19.1	22 58.6	8.3	22 28.1	3.8	56.8
16	60 27.9	19.5	37 25.9	8.3	22 24.3	4.0	56.8
17	75 27.7	19.8	51 53.2	8.4	22 20.3	4.2	56.8
18	90 27.6	N22 20.1	66 20.6	8.3	N22 16.1	4.2	56.8
19	105 27.5	20.4	80 47.9	8.4	22 11.9	4.4	56.8
20	120 27.4	20.7	95 15.3	8.4	22 07.5	4.5	56.9
21	135 27.3	21.0	109 42.7	8.3	22 03.0	4.7	56.9
22	150 27.2	21.3	124 10.0	8.5	21 58.3	4.7	56.9
23	165 27.1	21.6	138 37.5	8.4	21 53.6	4.9	56.9
4 00	180 27.0	N22 21.9	153 04.9	8.4	N21 48.7	5.0	56.9
01	195 26.9	22.2	167 32.3	8.5	21 43.7	5.2	57.0
02	210 26.8	22.5	181 59.8	8.4	21 38.5	5.3	57.0
03	225 26.7	22.8	196 27.2	8.5	21 33.2	5.4	57.0
04	240 26.6	23.1	210 54.7	8.5	21 27.8	5.5	57.0
05	255 26.5	23.4	225 22.2	8.6	21 22.3	5.6	57.1
06	270 26.4	N22 23.7	239 49.8	8.5	N21 16.7	5.8	57.1
07	285 26.3	24.0	254 17.3	8.6	21 10.9	5.9	57.1
S 08	300 26.2	24.3	268 44.9	8.6	21 05.0	6.0	57.1
A 09	315 26.1	24.5	283 12.5	8.6	20 59.0	6.2	57.1
T 10	330 25.9	24.8	297 40.1	8.7	20 52.8	6.2	57.2
U 11	345 25.8	25.1	312 07.8	8.7	20 46.6	6.4	57.2
R 12	0 25.7	N22 25.4	326 35.5	8.7	N20 40.2	6.5	57.2
D 13	15 25.6	25.7	341 03.2	8.7	20 33.7	6.6	57.2
A 14	30 25.5	26.0	355 30.9	8.8	20 27.1	6.8	57.2
Y 15	45 25.4	26.3	9 58.7	8.7	20 20.3	6.8	57.3
16	60 25.3	26.6	24 26.4	8.9	20 13.5	7.0	57.3
17	75 25.2	26.9	38 54.3	8.8	20 06.5	7.1	57.3
18	90 25.1	N22 27.2	53 22.1	8.9	N19 59.4	7.2	57.3
19	105 25.0	27.5	67 50.0	8.9	19 52.2	7.4	57.3
20	120 24.9	27.7	82 17.9	8.9	19 44.8	7.4	57.4
21	135 24.8	28.0	96 45.8	9.0	19 37.4	7.6	57.4
22	150 24.7	28.3	111 13.8	9.0	19 29.8	7.6	57.4
23	165 24.5	28.6	125 41.8	9.0	19 22.2	7.8	57.4
5 00	180 24.4	N22 28.9	140 09.8	9.1	N19 14.4	7.9	57.4
01	195 24.3	29.2	154 37.9	9.1	19 06.5	8.0	57.5
02	210 24.2	29.4	169 06.0	9.1	18 58.5	8.1	57.5
03	225 24.1	29.7	183 34.1	9.2	18 50.4	8.3	57.5
04	240 24.0	30.0	198 02.3	9.2	18 42.1	8.3	57.5
05	255 23.9	30.3	212 30.5	9.2	18 33.8	8.5	57.5
06	270 23.8	N22 30.6	226 58.7	9.3	N18 25.3	8.5	57.6
07	285 23.7	30.8	241 27.0	9.3	18 16.8	8.7	57.6
08	300 23.6	31.1	255 55.3	9.3	18 08.1	8.7	57.6
S 09	315 23.4	31.4	270 23.6	9.4	17 59.4	8.9	57.6
U 10	330 23.3	31.7	284 52.0	9.4	17 50.5	9.0	57.6
N 11	345 23.2	32.0	299 20.4	9.5	17 41.5	9.1	57.7
D 12	0 23.1	N22 32.2	313 48.9	9.5	N17 32.4	9.2	57.7
A 13	15 23.0	32.5	328 17.4	9.5	17 23.2	9.2	57.7
Y 14	30 22.9	32.8	342 45.9	9.6	17 14.0	9.4	57.7
15	45 22.8	33.1	357 14.5	9.6	17 04.6	9.5	57.7
16	60 22.7	33.3	11 43.1	9.6	16 55.1	9.6	57.8
17	75 22.6	33.6	26 11.7	9.7	16 45.5	9.7	57.8
18	90 22.4	N22 33.9	40 40.4	9.7	N16 35.8	9.7	57.8
19	105 22.3	34.1	55 09.1	9.7	16 26.1	9.9	57.8
20	120 22.2	34.4	69 37.8	9.8	16 16.2	10.0	57.8
21	135 22.1	34.7	84 06.6	9.8	16 06.2	10.0	57.9
22	150 22.0	35.0	98 35.4	9.9	15 56.2	10.2	57.9
23	165 21.9	35.2	113 04.3	9.8	N15 46.0	10.2	57.9
	SD 15.8	d 0.3	SD 15.4		15.6		15.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 3	Moonrise 4	Moonrise 5	Moonrise 6
°	h m	h m	h m	h m	h m	h m	h m
N 72							06 15
N 70						04 21	06 47
68					02 48	05 08	07 10
66	////	////	01 01	02 11	03 50	05 39	07 27
64	////	////	01 52	03 01	04 25	06 02	07 42
62	////	////	02 23	03 32	04 50	06 20	07 54
60	////	01 19	02 46	03 56	05 10	06 34	08 04
N 58	////	01 55	03 04	04 15	05 26	06 47	08 13
56	////	02 21	03 19	04 30	05 40	06 58	08 21
54	01 12	02 41	03 33	04 44	05 52	07 07	08 27
52	01 46	02 57	03 44	04 56	06 02	07 16	08 34
50	02 09	03 11	03 54	05 06	06 12	07 24	08 39
45	02 51	03 39	04 15	05 28	06 31	07 40	08 51
N 40	03 19	04 00	04 32	05 45	06 47	07 53	09 01
35	03 41	04 17	04 47	06 00	07 01	08 04	09 09
30	03 59	04 32	04 59	06 13	07 12	08 14	09 17
20	04 27	04 56	05 20	06 35	07 32	08 31	09 29
N 10	04 48	05 15	05 38	06 54	07 50	08 45	09 40
0	05 06	05 32	05 55	07 12	08 06	08 59	09 51
S 10	05 22	05 49	06 11	07 29	08 22	09 13	10 01
20	05 38	06 05	06 29	07 48	08 39	09 27	10 12
30	05 53	06 23	06 49	08 10	08 59	09 44	10 24
35	06 01	06 33	07 01	08 23	09 10	09 53	10 32
40	06 10	06 44	07 14	08 38	09 24	10 04	10 40
45	06 20	06 57	07 30	08 55	09 39	10 17	10 49
S 50	06 31	07 12	07 50	09 17	09 58	10 32	11 01
52	06 36	07 19	07 59	09 27	10 07	10 40	11 06
54	06 41	07 26	08 09	09 39	10 18	10 48	11 12
56	06 46	07 35	08 21	09 52	10 29	10 57	11 18
58	06 53	07 44	08 35	10 07	10 42	11 07	11 25
S 60	07 00	07 55	08 50	10 26	10 57	11 18	11 33

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 3	Moonset 4	Moonset 5	Moonset 6
°	h m	h m	h m	h m	h m	h m	h m
N 72							01 20
N 70						01 24	00 47
68					01 04	00 35	00 22
66	23 00	////	////	24 01	00 01	00 04	00 03
64	22 07	////	////	23 26	23 40	23 48	23 52
62	21 35	////	////	23 00	23 21	23 35	23 44
60	21 12	22 40	////	22 40	23 06	23 24	23 37
N 58	20 53	22 03	////	22 23	22 53	23 14	23 31
56	20 38	21 37	////	22 09	22 41	23 06	23 25
54	20 25	21 17	22 47	21 57	22 31	22 58	23 20
52	20 13	21 00	22 12	21 46	22 22	22 51	23 15
50	20 03	20 46	21 48	21 37	22 14	22 45	23 11
45	19 42	20 18	21 06	21 16	21 57	22 32	23 02
N 40	19 25	19 57	20 38	21 00	21 43	22 21	22 55
35	19 10	19 40	20 16	20 46	21 31	22 11	22 48
30	18 58	19 25	19 58	20 34	21 20	22 03	22 42
20	18 37	19 01	19 30	20 13	21 02	21 49	22 32
N 10	18 19	18 42	19 08	19 55	20 46	21 36	22 23
0	18 02	18 24	18 50	19 38	20 31	21 24	22 15
S 10	17 45	18 08	18 34	19 21	20 16	21 12	22 06
20	17 28	17 51	18 19	19 02	20 00	20 59	21 57
30	17 07	17 34	18 03	18 41	19 42	20 44	21 47
35	16 56	17 24	17 55	18 28	19 31	20 35	21 41
40	16 42	17 12	17 46	18 14	19 18	20 25	21 34
45	16 26	17 00	17 37	17 57	19 03	20 13	21 25
S 50	16 07	16 45	17 26	17 36	18 45	19 59	21 16
52	15 57	16 38	17 21	17 26	18 36	19 52	21 11
54	15 47	16 30	17 15	17 14	18 27	19 45	21 06
56	15 35	16 21	17 10	17 01	18 16	19 37	21 00
58	15 22	16 12	17 04	16 46	18 03	19 27	20 54
S 60	15 06	16 01	16 57	16 28	17 48	19 16	20 47

Day	SUN Eqn. of Time 00^h	SUN Eqn. of Time 12^h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
3	01 58	01 53	11 58	13 25	00 57	02	3
4	01 48	01 43	11 58	14 19	01 52	03	7
5	01 38	01 33	11 58	15 11	02 45	04	14

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.1		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
6 00	254 03.9	200 29.4	N18 02.2	207 20.4	N17 07.8	225 28.5	N10 31.1	63 24.5	S 1 45.9
01	269 06.3	215 28.8	03.0	222 21.0	08.4	240 30.4	31.3	78 27.0	45.9
02	284 08.8	230 28.1	03.8	237 21.6	08.9	255 32.4	31.5	93 29.5	45.9
03	299 11.2	245 27.5	04.6	252 22.3	09.4	270 34.4	31.6	108 32.0	45.9
04	314 13.7	260 26.9	05.4	267 22.9	09.9	285 36.4	31.8	123 34.5	45.9
05	329 16.2	275 26.2	06.2	282 23.5	10.5	300 38.3	32.0	138 37.0	45.9
06	344 18.6	290 25.6	N18 07.0	297 24.2	N17 11.0	315 40.3	N10 32.2	153 39.5	S 1 45.9
07	359 21.1	305 25.0	07.7	312 24.8	11.5	330 42.3	32.3	168 41.9	45.9
08	14 23.6	320 24.4	08.5	327 25.4	12.0	345 44.3	32.5	183 44.4	45.9
M 09	29 26.0	335 23.7	09.3	342 26.1	12.5	0 46.3	32.7	198 46.9	45.9
O 10	44 28.5	350 23.1	10.1	357 26.7	13.1	15 48.2	32.9	213 49.4	45.9
N 11	59 31.0	5 22.5	10.9	12 27.3	13.6	30 50.2	33.0	228 51.9	45.9
D 12	74 33.4	20 21.8	N18 11.7	27 28.0	N17 14.1	45 52.2	N10 33.2	243 54.4	S 1 45.9
A 13	89 35.9	35 21.2	12.5	42 28.6	14.6	60 54.2	33.4	258 56.9	45.9
Y 14	104 38.3	50 20.6	13.2	57 29.2	15.2	75 56.1	33.6	273 59.4	45.9
15	119 40.8	65 19.9	14.0	72 29.9	15.7	90 58.1	33.7	289 01.9	45.9
16	134 43.3	80 19.3	14.8	87 30.5	16.2	106 00.1	33.9	304 04.4	45.9
17	149 45.7	95 18.7	15.6	102 31.1	16.7	121 02.1	34.1	319 06.9	45.9
18	164 48.2	110 18.0	N18 16.4	117 31.8	N17 17.2	136 04.1	N10 34.2	334 09.4	S 1 45.9
19	179 50.7	125 17.4	17.2	132 32.4	17.7	151 06.0	34.4	349 11.9	45.9
20	194 53.1	140 16.8	17.9	147 33.0	18.3	166 08.0	34.6	4 14.4	45.9
21	209 55.6	155 16.1	18.7	162 33.7	18.8	181 10.0	34.8	19 16.9	45.9
22	224 58.1	170 15.5	19.5	177 34.3	19.3	196 12.0	34.9	34 19.3	45.9
23	240 00.5	185 14.9	20.3	192 34.9	19.8	211 14.0	35.1	49 21.8	45.9
7 00	255 03.0	200 14.2	N18 21.0	207 35.6	N17 20.3	226 15.9	N10 35.3	64 24.3	S 1 45.9
01	270 05.5	215 13.6	21.8	222 36.2	20.8	241 17.9	35.5	79 26.8	45.9
02	285 07.9	230 12.9	22.6	237 36.8	21.4	256 19.9	35.6	94 29.3	45.9
03	300 10.4	245 12.3	23.4	252 37.5	21.9	271 21.9	35.8	109 31.8	45.9
04	315 12.8	260 11.7	24.1	267 38.1	22.4	286 23.9	36.0	124 34.3	45.9
05	330 15.3	275 11.0	24.9	282 38.7	22.9	301 25.8	36.1	139 36.8	45.9
06	345 17.8	290 10.4	N18 25.7	297 39.4	N17 23.4	316 27.8	N10 36.3	154 39.3	S 1 45.9
07	0 20.2	305 09.7	26.4	312 40.0	23.9	331 29.8	36.5	169 41.8	45.9
T 08	15 22.7	320 09.1	27.2	327 40.6	24.5	346 31.8	36.7	184 44.3	45.9
U 09	30 25.2	335 08.5	28.0	342 41.3	25.0	1 33.8	36.8	199 46.8	45.9
E 10	45 27.6	350 07.8	28.7	357 41.9	25.5	16 35.7	37.0	214 49.2	45.9
S 11	60 30.1	5 07.2	29.5	12 42.5	26.0	31 37.7	37.2	229 51.7	45.9
D 12	75 32.6	20 06.5	N18 30.3	27 43.1	N17 26.5	46 39.7	N10 37.3	244 54.2	S 1 45.9
A 13	90 35.0	35 05.9	31.0	42 43.8	27.0	61 41.7	37.5	259 56.7	45.9
Y 14	105 37.5	50 05.3	31.8	57 44.4	27.5	76 43.7	37.7	274 59.2	45.9
15	120 40.0	65 04.6	32.6	72 45.0	28.0	91 45.7	37.9	290 01.7	45.9
16	135 42.4	80 04.0	33.3	87 45.7	28.6	106 47.6	38.0	305 04.2	45.9
17	150 44.9	95 03.3	34.1	102 46.3	29.1	121 49.6	38.2	320 06.7	45.9
18	165 47.3	110 02.7	N18 34.9	117 46.9	N17 29.6	136 51.6	N10 38.4	335 09.2	S 1 45.9
19	180 49.8	125 02.0	35.6	132 47.6	30.1	151 53.6	38.5	350 11.6	45.9
20	195 52.3	140 01.4	36.4	147 48.2	30.6	166 55.6	38.7	5 14.1	45.9
21	210 54.7	155 00.7	37.1	162 48.8	31.1	181 57.5	38.9	20 16.6	45.9
22	225 57.2	170 00.1	37.9	177 49.5	31.6	196 59.5	39.1	35 19.1	45.9
23	240 59.7	184 59.4	38.6	192 50.1	32.1	212 01.5	39.2	50 21.6	45.9
8 00	256 02.1	199 58.8	N18 39.4	207 50.7	N17 32.6	227 03.5	N10 39.4	65 24.1	S 1 45.9
01	271 04.6	214 58.1	40.2	222 51.3	33.1	242 05.5	39.6	80 26.6	45.9
02	286 07.1	229 57.5	40.9	237 52.0	33.7	257 07.5	39.7	95 29.1	45.9
03	301 09.5	244 56.8	41.7	252 52.6	34.2	272 09.4	39.9	110 31.6	45.9
04	316 12.0	259 56.2	42.4	267 53.2	34.7	287 11.4	40.1	125 34.0	45.9
05	331 14.4	274 55.5	43.2	282 53.9	35.2	302 13.4	40.2	140 36.5	45.9
06	346 16.9	289 54.9	N18 43.9	297 54.5	N17 35.7	317 15.4	N10 40.4	155 39.0	S 1 45.9
W 07	1 19.4	304 54.2	44.7	312 55.1	36.2	332 17.4	40.6	170 41.5	45.9
E 08	16 21.8	319 53.6	45.4	327 55.8	36.7	347 19.4	40.8	185 44.0	45.9
D 09	31 24.3	334 52.9	46.2	342 56.4	37.2	2 21.3	40.9	200 46.5	45.9
N 10	46 26.8	349 52.3	46.9	357 57.0	37.7	17 23.3	41.1	215 49.0	45.9
E 11	61 29.2	4 51.6	47.7	12 57.7	38.2	32 25.3	41.3	230 51.4	45.9
S 12	76 31.7	19 51.0	N18 48.4	27 58.3	N17 38.7	47 27.3	N10 41.4	245 53.9	S 1 45.9
D 13	91 34.2	34 50.3	49.1	42 58.9	39.2	62 29.3	41.6	260 56.4	45.9
A 14	106 36.6	49 49.7	49.9	57 59.5	39.7	77 31.3	41.8	275 58.9	45.9
Y 15	121 39.1	64 49.0	50.6	73 00.2	40.2	92 33.2	41.9	291 01.4	45.9
16	136 41.6	79 48.4	51.4	88 00.8	40.7	107 35.2	42.1	306 03.9	45.9
17	151 44.0	94 47.7	52.1	103 01.4	41.2	122 37.2	42.3	321 06.4	45.9
18	166 46.5	109 47.0	N18 52.9	118 02.1	N17 41.7	137 39.2	N10 42.5	336 08.8	S 1 45.9
19	181 48.9	124 46.4	53.6	133 02.7	42.3	152 41.2	42.6	351 11.3	45.9
20	196 51.4	139 45.7	54.3	148 03.3	42.8	167 43.2	42.8	6 13.8	45.9
21	211 53.9	154 45.1	55.1	163 03.9	43.3	182 45.2	43.0	21 16.3	45.9
22	226 56.3	169 44.4	55.8	178 04.6	43.8	197 47.1	43.1	36 18.8	45.9
23	241 58.8	184 43.7	56.6	193 05.2	44.3	212 49.1	43.3	51 21.3	45.9
	h m								
Mer. Pass.	6 58.7	*v* −0.6	*d* 0.8	*v* 0.6	*d* 0.5	*v* 2.0	*d* 0.2	*v* 2.5	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.4
Achernar	335 28.1	S57 10.4
Acrux	173 10.7	S63 10.2
Adhara	255 14.0	S28 59.4
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.6	N55 54.0
Alkaid	152 59.6	N49 15.5
Al Na'ir	27 45.4	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.6
Alpheratz	357 45.1	N29 09.1
Altair	62 09.4	N 8 54.0
Ankaa	353 17.2	S42 14.3
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.3	S69 02.9
Avior	234 19.1	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.5
Canopus	263 57.3	S52 42.3
Capella	280 37.1	N46 00.5
Deneb	49 32.2	N45 19.2
Denebola	182 35.1	N14 30.4
Diphda	348 57.5	S17 55.3
Dubhe	193 53.4	N61 41.5
Elnath	278 14.8	N28 36.9
Eltanin	90 46.3	N51 29.2
Enif	33 48.4	N 9 55.7
Fomalhaut	15 25.5	S29 33.4
Gacrux	172 02.4	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.5	S60 26.0
Hamal	328 02.7	N23 30.9
Kaus Aust.	83 45.3	S34 22.6
Kochab	137 18.8	N74 06.6
Markab	13 39.8	N15 16.0
Menkar	314 16.8	N 4 08.1
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.6	S69 46.2
Mirfak	308 42.9	N49 54.0
Nunki	75 59.8	S26 16.8
Peacock	53 21.1	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.4	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.1
Sabik	102 13.8	S15 44.3
Schedar	349 42.5	N56 35.8
Shaula	96 23.5	S37 06.7
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.8	S43 29.1
Vega	80 39.5	N38 47.6
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	305 11.2	10 40
Mars	312 32.6	10 09
Jupiter	331 13.0	8 54
Saturn	169 21.3	19 39

UT	SUN				MOON					
	GHA		Dec		GHA	v	Dec	d	HP	
d h	°	′	°	′	°	′	°	′	′	
6 00	180	21.8	N22	35.5	127	33.1	10.0	N15	35.8	10.4	57.9
01	195	21.7		35.8	142	02.1	9.9	15	25.4	10.4	57.9
02	210	21.5		36.0	156	31.0	10.0	15	15.0	10.5	58.0
03	225	21.4	. .	36.3	171	00.0	10.1	15	04.5	10.6	58.0
04	240	21.3		36.6	185	29.1	10.0	14	53.9	10.7	58.0
05	255	21.2		36.8	199	58.1	10.1	14	43.2	10.8	58.0
06	270	21.1	N22	37.1	214	27.2	10.2	N14	32.4	10.8	58.0
07	285	21.0		37.3	228	56.4	10.2	14	21.6	11.0	58.1
08	300	20.9		37.6	243	25.6	10.2	14	10.6	11.0	58.1
M 09	315	20.8	. .	37.9	257	54.8	10.2	13	59.6	11.1	58.1
O 10	330	20.6		38.1	272	24.0	10.3	13	48.5	11.2	58.1
N 11	345	20.5		38.4	286	53.3	10.3	13	37.3	11.3	58.1
D 12	0	20.4	N22	38.6	301	22.6	10.3	N13	26.0	11.3	58.1
A 13	15	20.3		38.9	315	51.9	10.4	13	14.7	11.4	58.2
Y 14	30	20.2		39.2	330	21.3	10.4	13	03.3	11.5	58.2
15	45	20.1	. .	39.4	344	50.7	10.5	12	51.8	11.6	58.2
16	60	20.0		39.7	359	20.2	10.4	12	40.2	11.7	58.2
17	75	19.8		39.9	13	49.6	10.6	12	28.5	11.7	58.2
18	90	19.7	N22	40.2	28	19.2	10.5	N12	16.8	11.8	58.3
19	105	19.6		40.4	42	48.7	10.6	12	05.0	11.9	58.3
20	120	19.5		40.7	57	18.3	10.5	11	53.1	11.9	58.3
21	135	19.4	. .	40.9	71	47.8	10.7	11	41.2	12.0	58.3
22	150	19.3		41.2	86	17.5	10.6	11	29.2	12.1	58.3
23	165	19.2		41.5	100	47.1	10.7	11	17.1	12.1	58.3
7 00	180	19.0	N22	41.7	115	16.8	10.7	N11	05.0	12.2	58.4
01	195	18.9		42.0	129	46.5	10.7	10	52.8	12.3	58.4
02	210	18.8		42.2	144	16.2	10.8	10	40.5	12.3	58.4
03	225	18.7	. .	42.5	158	46.0	10.8	10	28.2	12.4	58.4
04	240	18.6		42.7	173	15.8	10.8	10	15.8	12.5	58.4
05	255	18.5		42.9	187	45.6	10.8	10	03.3	12.5	58.5
06	270	18.3	N22	43.2	202	15.4	10.9	N 9	50.8	12.6	58.5
07	285	18.2		43.4	216	45.3	10.9	9	38.2	12.6	58.5
T 08	300	18.1		43.7	231	15.2	10.9	9	25.6	12.7	58.5
U 09	315	18.0	. .	43.9	245	45.1	10.9	9	12.9	12.8	58.5
E 10	330	17.9		44.2	260	15.0	11.0	9	00.1	12.8	58.5
S 11	345	17.8		44.4	274	45.0	10.9	8	47.3	12.8	58.6
D 12	0	17.6	N22	44.7	289	14.9	11.0	N 8	34.5	12.9	58.6
A 13	15	17.5		44.9	303	44.9	11.0	8	21.6	13.0	58.6
Y 14	30	17.4		45.1	318	14.9	11.0	8	08.6	13.0	58.6
15	45	17.3	. .	45.4	332	44.9	11.1	7	55.6	13.1	58.6
16	60	17.2		45.6	347	15.0	11.0	7	42.5	13.1	58.6
17	75	17.1		45.9	1	45.0	11.1	7	29.4	13.1	58.7
18	90	16.9	N22	46.1	16	15.1	11.1	N 7	16.3	13.2	58.7
19	105	16.8		46.3	30	45.2	11.1	7	03.1	13.3	58.7
20	120	16.7		46.6	45	15.3	11.1	6	49.8	13.2	58.7
21	135	16.6	. .	46.8	59	45.4	11.1	6	36.6	13.4	58.7
22	150	16.5		47.0	74	15.5	11.2	6	23.2	13.3	58.7
23	165	16.4		47.3	88	45.7	11.1	6	09.9	13.4	58.8
8 00	180	16.2	N22	47.5	103	15.8	11.2	N 5	56.5	13.5	58.8
01	195	16.1		47.8	117	46.0	11.1	5	43.0	13.5	58.8
02	210	16.0		48.0	132	16.1	11.2	5	29.5	13.5	58.8
03	225	15.9	. .	48.2	146	46.3	11.2	5	16.0	13.5	58.8
04	240	15.8		48.4	161	16.5	11.2	5	02.5	13.6	58.8
05	255	15.6		48.7	175	46.7	11.2	4	48.9	13.6	58.9
06	270	15.5	N22	48.9	190	16.9	11.1	N 4	35.3	13.7	58.9
W 07	285	15.4		49.1	204	47.0	11.2	4	21.6	13.7	58.9
E 08	300	15.3		49.4	219	17.2	11.2	4	07.9	13.7	58.9
D 09	315	15.2	. .	49.6	233	47.4	11.3	3	54.2	13.7	58.9
N 10	330	15.1		49.8	248	17.7	11.2	3	40.5	13.8	58.9
E 11	345	14.9		50.0	262	47.9	11.2	3	26.7	13.7	58.9
S 12	0	14.8	N22	50.3	277	18.1	11.2	N 3	13.0	13.9	59.0
D 13	15	14.7		50.5	291	48.3	11.2	2	59.1	13.8	59.0
A 14	30	14.6		50.7	306	18.5	11.2	2	45.3	13.8	59.0
Y 15	45	14.5	. .	50.9	320	48.7	11.1	2	31.5	13.9	59.0
16	60	14.3		51.2	335	18.8	11.2	2	17.6	13.9	59.0
17	75	14.2		51.4	349	49.0	11.2	2	03.7	13.9	59.0
18	90	14.1	N22	51.6	4	19.2	11.2	N 1	49.8	13.9	59.1
19	105	14.0		51.8	18	49.4	11.1	1	35.9	14.0	59.1
20	120	13.9		52.1	33	19.5	11.2	1	21.9	13.9	59.1
21	135	13.7	. .	52.3	47	49.7	11.1	1	08.0	14.0	59.1
22	150	13.6		52.5	62	19.8	11.2	0	54.0	14.0	59.1
23	165	13.5		52.7	76	50.0	11.1	N 0	40.0	14.0	59.1
	SD	15.8	d	0.2	SD		15.8		16.0		16.1

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		6	7	8	9
°	h m	h m	h m	h m	h m	h m	h m
N 72				06 15	08 37	10 47	12 54
N 70				06 47	08 52	10 52	12 50
68				07 10	09 04	10 56	12 47
66	////	////	00 47	07 27	09 14	10 59	12 45
64	////	////	01 45	07 42	09 22	11 02	12 42
62	////	////	02 18	07 54	09 29	11 04	12 40
60	////	01 11	02 42	08 04	09 35	11 06	12 39
N 58	////	01 51	03 01	08 13	09 40	11 08	12 37
56	////	02 17	03 17	08 21	09 45	11 10	12 36
54	01 04	02 38	03 30	08 27	09 49	11 11	12 35
52	01 41	02 55	03 42	08 34	09 53	11 13	12 34
50	02 06	03 09	03 53	08 39	09 56	11 14	12 33
45	02 49	03 37	04 14	08 51	10 04	11 17	12 30
N 40	03 18	03 59	04 31	09 01	10 10	11 19	12 29
35	03 40	04 17	04 46	09 09	10 15	11 21	12 27
30	03 58	04 31	04 59	09 17	10 19	11 22	12 26
20	04 26	04 55	05 20	09 29	10 27	11 25	12 24
N 10	04 48	05 15	05 38	09 40	10 34	11 28	12 22
0	05 07	05 33	05 55	09 51	10 41	11 30	12 20
S 10	05 23	05 49	06 12	10 01	10 47	11 33	12 18
20	05 39	06 06	06 30	10 12	10 54	11 35	12 16
30	05 55	06 24	06 50	10 24	11 02	11 38	12 14
35	06 03	06 34	07 02	10 32	11 07	11 40	12 13
40	06 12	06 46	07 16	10 40	11 12	11 42	12 12
45	06 22	06 59	07 32	10 49	11 18	11 44	12 10
S 50	06 33	07 14	07 52	11 01	11 25	11 47	12 08
52	06 38	07 21	08 02	11 06	11 28	11 48	12 08
54	06 43	07 29	08 12	11 12	11 32	11 49	12 07
56	06 49	07 38	08 24	11 18	11 35	11 51	12 06
58	06 55	07 47	08 38	11 25	11 40	11 52	12 05
S 60	07 03	07 58	08 55	11 33	11 45	11 54	12 03

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	6	7	8	9
°	h m	h m	h m	h m	h m	h m	h m
N 72				01 20	00 44	(00 19 / 23 58)	23 37
N 70				00 47	00 27	(00 11 / 23 58)	23 44
68				00 22	00 13	(00 05 / 23 57)	23 50
66	23 16	////	////	00 03	00 02	(00 00 / 23 57)	23 55
64	22 14	////	////	23 52	23 55	23 57	23 59
62	21 41	////	////	23 44	23 51	23 57	24 02
60	21 16	22 49	////	23 37	23 47	23 56	24 06
N 58	20 57	22 08	////	23 31	23 44	23 56	24 09
56	20 41	21 41	////	23 25	23 41	23 56	24 11
54	20 28	21 21	22 55	23 20	23 39	23 56	24 13
52	20 16	21 04	22 18	23 15	23 36	23 56	24 16
50	20 06	20 49	21 52	23 11	23 34	23 56	24 17
45	19 44	20 21	21 09	23 02	23 29	23 55	24 22
N 40	19 26	19 59	20 40	22 55	23 26	23 55	24 25
35	19 12	19 41	20 18	22 48	23 22	23 55	24 28
30	18 59	19 27	20 00	22 42	23 19	23 55	24 31
20	18 38	19 02	19 31	22 32	23 14	23 54	24 36
N 10	18 20	18 42	19 09	22 23	23 09	23 54	24 40
0	18 02	18 25	18 51	22 15	23 05	23 54	24 44
S 10	17 46	18 08	18 35	22 06	23 00	23 54	24 48
20	17 28	17 52	18 19	21 57	22 55	23 53	24 52
30	17 07	17 33	18 03	21 47	22 50	23 53	24 57
35	16 55	17 23	17 55	21 41	22 46	23 52	24 59
40	16 41	17 12	17 46	21 34	22 43	23 52	25 02
45	16 25	16 59	17 36	21 25	22 38	23 52	25 06
S 50	16 05	16 43	17 25	21 16	22 33	23 51	25 10
52	15 56	16 36	17 20	21 11	22 31	23 51	25 12
54	15 45	16 28	17 14	21 06	22 28	23 51	25 14
56	15 33	16 20	17 08	21 00	22 25	23 50	25 17
58	15 19	16 10	17 02	20 54	22 22	23 50	25 20
S 60	15 03	15 59	16 55	20 47	22 18	23 50	25 23

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
6	01 27	01 22	11 59	16 03	03 37	05	22
7	01 16	01 11	11 59	16 53	04 28	06	32
8	01 05	00 59	11 59	17 42	05 17	07	43

UT	ARIES	VENUS −3.8		MARS +1.3		JUPITER −2.2		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
9 00	257 01.3	199 43.1	N18 57.3	208 05.8	N17 44.8	227 51.1	N10 43.5	66 23.8	S 1 45.9
01	272 03.7	214 42.4	58.0	223 06.5	45.3	242 53.1	43.6	81 26.2	45.9
02	287 06.2	229 41.8	58.8	238 07.1	45.8	257 55.1	43.8	96 28.7	45.9
03	302 08.7	244 41.1	18 59.5	253 07.7	46.3	272 57.1	44.0	111 31.2	45.9
04	317 11.1	259 40.4	19 00.2	268 08.3	46.8	287 59.1	44.1	126 33.7	45.9
05	332 13.6	274 39.8	01.0	283 09.0	47.3	303 01.0	44.3	141 36.2	45.9
06	347 16.1	289 39.1	N19 01.7	298 09.6	N17 47.8	318 03.0	N10 44.5	156 38.7	S 1 45.9
07	2 18.5	304 38.5	02.4	313 10.2	48.3	333 05.0	44.7	171 41.1	45.9
T 08	17 21.0	319 37.8	03.1	328 10.9	48.8	348 07.0	44.8	186 43.6	45.9
H 09	32 23.4	334 37.1	03.9	343 11.5	49.3	3 09.0	45.0	201 46.1	45.9
U 10	47 25.9	349 36.5	04.6	358 12.1	49.8	18 11.0	45.2	216 48.6	45.9
R 11	62 28.4	4 35.8	05.3	13 12.7	50.3	33 13.0	45.3	231 51.1	45.9
S 12	77 30.8	19 35.1	N19 06.0	28 13.4	N17 50.8	48 15.0	N10 45.5	246 53.6	S 1 45.9
D 13	92 33.3	34 34.5	06.8	43 14.0	51.3	63 16.9	45.7	261 56.0	46.0
A 14	107 35.8	49 33.8	07.5	58 14.6	51.8	78 18.9	45.8	276 58.5	46.0
Y 15	122 38.2	64 33.1	08.2	73 15.3	52.3	93 20.9	46.0	292 01.0	46.0
16	137 40.7	79 32.5	08.9	88 15.9	52.7	108 22.9	46.2	307 03.5	46.0
17	152 43.2	94 31.8	09.7	103 16.5	53.2	123 24.9	46.3	322 06.0	46.0
18	167 45.6	109 31.1	N19 10.4	118 17.1	N17 53.7	138 26.9	N10 46.5	337 08.4	S 1 46.0
19	182 48.1	124 30.5	11.1	133 17.8	54.2	153 28.9	46.7	352 10.9	46.0
20	197 50.5	139 29.8	11.8	148 18.4	54.7	168 30.9	46.8	7 13.4	46.0
21	212 53.0	154 29.1	12.5	163 19.0	55.2	183 32.8	47.0	22 15.9	46.0
22	227 55.5	169 28.5	13.2	178 19.7	55.7	198 34.8	47.2	37 18.4	46.0
23	242 57.9	184 27.8	14.0	193 20.3	56.2	213 36.8	47.3	52 20.8	46.0
10 00	258 00.4	199 27.1	N19 14.7	208 20.9	N17 56.7	228 38.8	N10 47.5	67 23.3	S 1 46.0
01	273 02.9	214 26.4	15.4	223 21.5	57.2	243 40.8	47.7	82 25.8	46.0
02	288 05.3	229 25.8	16.1	238 22.2	57.7	258 42.8	47.8	97 28.3	46.0
03	303 07.8	244 25.1	16.8	253 22.8	58.2	273 44.8	48.0	112 30.8	46.0
04	318 10.3	259 24.4	17.5	268 23.4	58.7	288 46.8	48.2	127 33.2	46.0
05	333 12.7	274 23.8	18.2	283 24.0	59.2	303 48.8	48.3	142 35.7	46.0
06	348 15.2	289 23.1	N19 19.0	298 24.7	N17 59.7	318 50.7	N10 48.5	157 38.2	S 1 46.0
07	3 17.7	304 22.4	19.7	313 25.3	18 00.2	333 52.7	48.7	172 40.7	46.0
08	18 20.1	319 21.7	20.4	328 25.9	00.7	348 54.7	48.8	187 43.2	46.0
F 09	33 22.6	334 21.1	21.1	343 26.6	01.1	3 56.7	49.0	202 45.6	46.0
R 10	48 25.0	349 20.4	21.8	358 27.2	01.6	18 58.7	49.2	217 48.1	46.0
I 11	63 27.5	4 19.7	22.5	13 27.8	02.1	34 00.7	49.3	232 50.6	46.0
D 12	78 30.0	19 19.0	N19 23.2	28 28.4	N18 02.6	49 02.7	N10 49.5	247 53.1	S 1 46.0
A 13	93 32.4	34 18.3	23.9	43 29.1	03.1	64 04.7	49.7	262 55.6	46.1
Y 14	108 34.9	49 17.7	24.6	58 29.7	03.6	79 06.7	49.8	277 58.0	46.1
15	123 37.4	64 17.0	25.3	73 30.3	04.1	94 08.7	50.0	293 00.5	46.1
16	138 39.8	79 16.3	26.0	88 30.9	04.6	109 10.6	50.2	308 03.0	46.1
17	153 42.3	94 15.6	26.7	103 31.6	05.1	124 12.6	50.3	323 05.5	46.1
18	168 44.8	109 15.0	N19 27.4	118 32.2	N18 05.6	139 14.6	N10 50.5	338 07.9	S 1 46.1
19	183 47.2	124 14.3	28.1	133 32.8	06.0	154 16.6	50.7	353 10.4	46.1
20	198 49.7	139 13.6	28.8	148 33.4	06.5	169 18.6	50.8	8 12.9	46.1
21	213 52.1	154 12.9	29.5	163 34.1	07.0	184 20.6	51.0	23 15.4	46.1
22	228 54.6	169 12.2	30.2	178 34.7	07.5	199 22.6	51.2	38 17.9	46.1
23	243 57.1	184 11.6	30.9	193 35.3	08.0	214 24.6	51.3	53 20.3	46.1
11 00	258 59.5	199 10.9	N19 31.6	208 35.9	N18 08.5	229 26.6	N10 51.5	68 22.8	S 1 46.1
01	274 02.0	214 10.2	32.3	223 36.6	09.0	244 28.6	51.7	83 25.3	46.1
02	289 04.5	229 09.5	33.0	238 37.2	09.4	259 30.6	51.8	98 27.8	46.1
03	304 06.9	244 08.8	33.6	253 37.8	09.9	274 32.6	52.0	113 30.2	46.1
04	319 09.4	259 08.1	34.3	268 38.5	10.4	289 34.5	52.2	128 32.7	46.1
05	334 11.9	274 07.4	35.0	283 39.1	10.9	304 36.5	52.3	143 35.2	46.1
06	349 14.3	289 06.8	N19 35.7	298 39.7	N18 11.4	319 38.5	N10 52.5	158 37.7	S 1 46.1
07	4 16.8	304 06.1	36.4	313 40.3	11.9	334 40.5	52.7	173 40.1	46.2
S 08	19 19.3	319 05.4	37.1	328 41.0	12.4	349 42.5	52.8	188 42.6	46.2
A 09	34 21.7	334 04.7	37.8	343 41.6	12.8	4 44.5	53.0	203 45.1	46.2
T 10	49 24.2	349 04.0	38.5	358 42.2	13.3	19 46.5	53.2	218 47.6	46.2
U 11	64 26.6	4 03.3	39.1	13 42.8	13.8	34 48.5	53.3	233 50.0	46.2
R 12	79 29.1	19 02.6	N19 39.8	28 43.5	N18 14.3	49 50.5	N10 53.5	248 52.5	S 1 46.2
D 13	94 31.6	34 02.0	40.5	43 44.1	14.8	64 52.5	53.7	263 55.0	46.2
A 14	109 34.0	49 01.3	41.2	58 44.7	15.3	79 54.5	53.8	278 57.5	46.2
Y 15	124 36.5	64 00.6	41.9	73 45.3	15.7	94 56.5	54.0	293 59.9	46.2
16	139 39.0	78 59.9	42.6	88 46.0	16.2	109 58.5	54.2	309 02.4	46.2
17	154 41.4	93 59.2	43.2	103 46.6	16.7	125 00.5	54.3	324 04.9	46.2
18	169 43.9	108 58.5	N19 43.9	118 47.2	N18 17.2	140 02.4	N10 54.5	339 07.4	S 1 46.2
19	184 46.4	123 57.8	44.6	133 47.8	17.7	155 04.4	54.7	354 09.8	46.2
20	199 48.8	138 57.1	45.3	148 48.5	18.1	170 06.4	54.8	9 12.3	46.2
21	214 51.3	153 56.4	45.9	163 49.1	18.6	185 08.4	55.0	24 14.8	46.2
22	229 53.8	168 55.7	46.6	178 49.7	19.1	200 10.4	55.1	39 17.3	46.3
23	244 56.2	183 55.0	47.3	193 50.3	19.6	215 12.4	55.3	54 19.7	46.3
	h m								
Mer. Pass.	6 46.9	*v* −0.7	*d* 0.7	*v* 0.6	*d* 0.5	*v* 2.0	*d* 0.2	*v* 2.5	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.8	S40 15.4
Achernar	335 28.1	S57 10.4
Acrux	173 10.8	S63 10.2
Adhara	255 14.0	S28 59.4
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.6	N55 54.0
Alkaid	152 59.7	N49 15.5
Al Na'ir	27 45.3	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.6
Alpheratz	357 45.1	N29 09.1
Altair	62 09.4	N 8 54.0
Ankaa	353 17.2	S42 14.3
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.2	S69 02.9
Avior	234 19.1	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.5
Canopus	263 57.3	S52 42.3
Capella	280 37.1	N46 00.5
Deneb	49 32.2	N45 19.2
Denebola	182 35.1	N14 30.4
Diphda	348 57.4	S17 55.3
Dubhe	193 53.4	N61 41.5
Elnath	278 14.8	N28 36.9
Eltanin	90 46.3	N51 29.2
Enif	33 48.4	N 9 55.7
Fomalhaut	15 25.5	S29 33.4
Gacrux	172 02.4	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.6	S60 26.0
Hamal	328 02.6	N23 30.9
Kaus Aust.	83 45.3	S34 22.6
Kochab	137 18.8	N74 06.6
Markab	13 39.8	N15 16.0
Menkar	314 16.8	N 4 08.1
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.6	S69 46.2
Mirfak	308 42.9	N49 54.0
Nunki	75 59.7	S26 16.8
Peacock	53 21.0	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.4	N12 33.1
Regulus	207 45.1	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.4	N56 35.8
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.1
Spica	158 32.6	S11 13.4
Suhail	222 53.8	S43 29.1
Vega	80 39.5	N38 47.6
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	301 26.7	10 43
Mars	310 20.5	10 06
Jupiter	330 38.4	8 44
Saturn	169 22.9	19 27

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
9 00	180 13.4	N22 52.9	91 20.1	11.1	N 0 26.0	14.0	59.1
01	195 13.3	53.1	105 50.2	11.1	N 0 12.0	14.0	59.2
02	210 13.1	53.4	120 20.3	11.1	S 0 02.0	14.0	59.2
03	225 13.0	53.6	134 50.4	11.1	0 16.0	14.0	59.2
04	240 12.9	53.8	149 20.5	11.0	0 30.0	14.0	59.2
05	255 12.8	54.0	163 50.5	11.0	0 44.0	14.0	59.2
06	270 12.6	N22 54.2	178 20.5	11.0	S 0 58.0	14.1	59.2
07	285 12.5	54.4	192 50.5	11.0	1 12.1	14.0	59.2
T 08	300 12.4	54.6	207 20.5	11.0	1 26.1	14.0	59.2
H 09	315 12.3	54.9	221 50.5	10.9	1 40.1	14.0	59.3
U 10	330 12.2	55.1	236 20.4	11.0	1 54.1	14.0	59.3
R 11	345 12.0	55.3	250 50.4	10.9	2 08.1	14.1	59.3
S 12	0 11.9	N22 55.5	265 20.3	10.8	S 2 22.2	14.0	59.3
D 13	15 11.8	55.7	279 50.1	10.9	2 36.2	14.0	59.3
A 14	30 11.7	55.9	294 20.0	10.8	2 50.2	13.9	59.3
Y 15	45 11.6	56.1	308 49.8	10.8	3 04.1	14.0	59.3
16	60 11.4	56.3	323 19.6	10.8	3 18.1	14.0	59.3
17	75 11.3	56.5	337 49.4	10.7	3 32.1	13.9	59.4
18	90 11.2	N22 56.7	352 19.1	10.7	S 3 46.0	14.0	59.4
19	105 11.1	56.9	6 48.8	10.7	4 00.0	13.9	59.4
20	120 10.9	57.1	21 18.5	10.6	4 13.9	13.9	59.4
21	135 10.8	57.3	35 48.1	10.6	4 27.8	13.9	59.4
22	150 10.7	57.5	50 17.7	10.6	4 41.7	13.8	59.4
23	165 10.6	57.7	64 47.3	10.5	4 55.5	13.9	59.4
10 00	180 10.4	N22 57.9	79 16.8	10.5	S 5 09.4	13.8	59.4
01	195 10.3	58.1	93 46.3	10.5	5 23.2	13.8	59.4
02	210 10.2	58.3	108 15.8	10.4	5 37.0	13.7	59.5
03	225 10.1	58.5	122 45.2	10.4	5 50.7	13.8	59.5
04	240 10.0	58.7	137 14.6	10.3	6 04.5	13.7	59.5
05	255 09.8	58.9	151 43.9	10.4	6 18.2	13.7	59.5
06	270 09.7	N22 59.1	166 13.3	10.2	S 6 31.9	13.6	59.5
07	285 09.6	59.3	180 42.5	10.2	6 45.5	13.7	59.5
08	300 09.5	59.5	195 11.7	10.2	6 59.2	13.5	59.5
F 09	315 09.3	59.7	209 40.9	10.1	7 12.7	13.6	59.5
R 10	330 09.2	22 59.9	224 10.0	10.1	7 26.3	13.5	59.5
I 11	345 09.1	23 00.1	238 39.1	10.0	7 39.8	13.5	59.5
D 12	0 09.0	N23 00.3	253 08.1	10.0	S 7 53.3	13.4	59.5
A 13	15 08.8	00.5	267 37.1	10.0	8 06.7	13.4	59.6
Y 14	30 08.7	00.7	282 06.1	9.9	8 20.1	13.3	59.6
15	45 08.6	00.9	296 35.0	9.8	8 33.4	13.3	59.6
16	60 08.5	01.1	311 03.8	9.8	8 46.7	13.3	59.6
17	75 08.3	01.2	325 32.6	9.7	9 00.0	13.2	59.6
18	90 08.2	N23 01.4	340 01.3	9.7	S 9 13.2	13.2	59.6
19	105 08.1	01.6	354 30.0	9.7	9 26.4	13.1	59.6
20	120 08.0	01.8	8 58.7	9.5	9 39.5	13.1	59.6
21	135 07.8	02.0	23 27.2	9.6	9 52.6	13.0	59.6
22	150 07.7	02.2	37 55.8	9.4	10 05.6	12.9	59.6
23	165 07.6	02.4	52 24.2	9.5	10 18.5	12.9	59.6
11 00	180 07.5	N23 02.6	66 52.7	9.3	S10 31.4	12.9	59.6
01	195 07.3	02.7	81 21.0	9.3	10 44.3	12.8	59.6
02	210 07.2	02.9	95 49.3	9.3	10 57.1	12.7	59.6
03	225 07.1	03.1	110 17.6	9.2	11 09.8	12.6	59.7
04	240 07.0	03.3	124 45.8	9.1	11 22.4	12.6	59.7
05	255 06.8	03.5	139 13.9	9.1	11 35.0	12.6	59.7
06	270 06.7	N23 03.6	153 42.0	9.0	S11 47.6	12.4	59.7
07	285 06.6	03.8	168 10.0	8.9	12 00.0	12.4	59.7
S 08	300 06.5	04.0	182 37.9	8.9	12 12.4	12.4	59.7
A 09	315 06.3	04.2	197 05.8	8.8	12 24.8	12.2	59.7
T 10	330 06.2	04.4	211 33.6	8.8	12 37.0	12.2	59.7
U 11	345 06.1	04.5	226 01.4	8.7	12 49.2	12.1	59.7
R 12	0 06.0	N23 04.7	240 29.1	8.6	S13 01.3	12.1	59.7
D 13	15 05.8	04.9	254 56.7	8.6	13 13.4	11.9	59.7
A 14	30 05.7	05.1	269 24.3	8.5	13 25.3	11.9	59.7
Y 15	45 05.6	05.2	283 51.8	8.5	13 37.2	11.8	59.7
16	60 05.5	05.4	298 19.3	8.4	13 49.0	11.7	59.7
17	75 05.3	05.6	312 46.7	8.3	14 00.7	11.7	59.7
18	90 05.2	N23 05.7	327 14.0	8.2	S14 12.4	11.5	59.7
19	105 05.1	05.9	341 41.2	8.2	14 23.9	11.5	59.7
20	120 05.0	06.1	356 08.4	8.2	14 35.4	11.4	59.7
21	135 04.8	06.2	10 35.6	8.0	14 46.8	11.3	59.7
22	150 04.7	06.4	25 02.6	8.0	14 58.1	11.2	59.7
23	165 04.6	06.6	39 29.6	8.0	S15 09.3	11.1	59.7
	SD 15.8	d 0.2	SD 16.2		16.2		16.3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 9	Moonrise 10	Moonrise 11	Moonrise 12
	h m	h m	h m	h m	h m	h m	h m
N 72				12 54	15 07	17 37	
N 70				12 50	14 53	17 05	19 46
68				12 47	14 42	16 42	18 54
66	////	////	00 31	12 45	14 32	16 25	18 22
64	////	////	01 40	12 42	14 25	16 10	17 58
62	////	////	02 15	12 40	14 18	15 58	17 40
60	////	01 03	02 39	12 39	14 12	15 48	17 25
N 58	////	01 47	02 59	12 37	14 07	15 40	17 12
56	////	02 14	03 15	12 36	14 03	15 32	17 01
54	00 58	02 35	03 29	12 35	13 59	15 25	16 51
52	01 38	02 53	03 41	12 34	13 56	15 19	16 42
50	02 04	03 07	03 51	12 33	13 52	15 13	16 35
45	02 47	03 36	04 13	12 30	13 45	15 02	16 18
N 40	03 17	03 58	04 31	12 29	13 40	14 52	16 05
35	03 40	04 16	04 46	12 27	13 35	14 44	15 53
30	03 58	04 31	04 58	12 26	13 30	14 36	15 44
20	04 26	04 55	05 20	12 24	13 23	14 24	15 27
N 10	04 49	05 16	05 38	12 22	13 17	14 13	15 12
0	05 07	05 33	05 56	12 20	13 11	14 03	14 58
S 10	05 24	05 50	06 13	12 18	13 05	13 53	14 45
20	05 40	06 07	06 31	12 16	12 58	13 43	14 31
30	05 56	06 25	06 52	12 14	12 51	13 31	14 14
35	06 04	06 36	07 04	12 13	12 47	13 24	14 05
40	06 13	06 47	07 18	12 12	12 42	13 16	13 54
45	06 23	07 01	07 34	12 10	12 37	13 07	13 41
S 50	06 35	07 16	07 54	12 08	12 31	12 56	13 26
52	06 40	07 23	08 04	12 08	12 28	12 51	13 19
54	06 45	07 31	08 15	12 07	12 25	12 46	13 11
56	06 51	07 40	08 27	12 06	12 21	12 40	13 02
58	06 58	07 50	08 41	12 05	12 18	12 33	12 53
S 60	07 05	08 01	08 58	12 03	12 13	12 25	12 41

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 9	Moonset 10	Moonset 11	Moonset 12
°	h m	h m	h m	h m	h m	h m	h m
N 72				23 37	23 12	22 33	
N 70				23 44	23 28	23 07	22 23
68				23 50	23 41	23 31	23 16
66	23 35	////	////	23 55	23 52	23 50	23 49
64	22 20	////	////	23 59	24 01	00 01	00 06
62	21 45	////	////	24 02	00 02	00 09	00 19
60	21 20	22 58	////	24 06	00 06	00 16	00 30
N 58	21 00	22 13	////	24 09	00 09	00 22	00 39
56	20 44	21 45	////	24 11	00 11	00 28	00 48
54	20 30	21 24	23 03	24 13	00 13	00 33	00 55
52	20 18	21 07	22 22	24 16	00 16	00 37	01 02
50	20 08	20 52	21 56	24 17	00 17	00 41	01 08
45	19 46	20 23	21 12	24 22	00 22	00 50	01 21
N 40	19 28	20 01	20 42	24 25	00 25	00 57	01 32
35	19 13	19 43	20 19	24 28	00 28	01 03	01 42
30	19 01	19 28	20 01	24 31	00 31	01 09	01 50
20	18 39	19 03	19 33	24 36	00 36	01 19	02 05
N 10	18 20	18 43	19 10	24 40	00 40	01 27	02 17
0	18 03	18 26	18 52	24 44	00 44	01 35	02 29
S 10	17 46	18 09	18 35	24 48	00 48	01 43	02 41
20	17 28	17 52	18 19	24 52	00 52	01 52	02 54
30	17 07	17 33	18 03	24 57	00 57	02 02	03 08
35	16 55	17 23	17 54	24 59	00 59	02 07	03 17
40	16 41	17 11	17 45	25 02	01 02	02 14	03 27
45	16 24	16 58	17 35	25 06	01 06	02 22	03 38
S 50	16 04	16 42	17 24	25 10	01 10	02 31	03 52
52	15 55	16 35	17 19	25 12	01 12	02 35	03 58
54	15 44	16 27	17 13	25 14	01 14	02 40	04 06
56	15 32	16 18	17 07	25 17	01 17	02 45	04 14
58	15 17	16 08	17 01	25 20	01 20	02 51	04 23
S 60	15 00	15 57	16 53	25 23	01 23	02 57	04 33

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
9	00 54	00 48	11 59	18 32	06 07	08	55
10	00 42	00 36	11 59	19 23	06 57	09	66
11	00 30	00 24	12 00	20 16	07 49	10	77

UT	ARIES	VENUS −3.8		MARS +1.4		JUPITER −2.2		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
12 00	259 58.7	198 54.4	N19 48.0	208 50.9	N18 20.1	230 14.4	N10 55.5	69 22.2	S 1 46.3
01	275 01.1	213 53.7	48.6	223 51.6	20.5	245 16.4	55.6	84 24.7	46.3
02	290 03.6	228 53.0	49.3	238 52.2	21.0	260 18.4	55.8	99 27.1	46.3
03	305 06.1	243 52.3	50.0	253 52.8	21.5	275 20.4	56.0	114 29.6	46.3
04	320 08.5	258 51.6	50.6	268 53.4	22.0	290 22.4	56.1	129 32.1	46.3
05	335 11.0	273 50.9	51.3	283 54.1	22.5	305 24.4	56.3	144 34.6	46.3
06	350 13.5	288 50.2	N19 52.0	298 54.7	N18 22.9	320 26.4	N10 56.5	159 37.0	S 1 46.3
07	5 15.9	303 49.5	52.6	313 55.3	23.4	335 28.4	56.6	174 39.5	46.3
08	20 18.4	318 48.8	53.3	328 55.9	23.9	350 30.4	56.8	189 42.0	46.3
S 09	35 20.9	333 48.1	54.0	343 56.6	24.4	5 32.4	56.9	204 44.4	46.3
U 10	50 23.3	348 47.4	54.6	358 57.2	24.8	20 34.4	57.1	219 46.9	46.3
N 11	65 25.8	3 46.7	55.3	13 57.8	25.3	35 36.4	57.3	234 49.4	46.4
D 12	80 28.2	18 46.0	N19 55.9	28 58.4	N18 25.8	50 38.4	N10 57.4	249 51.9	S 1 46.4
A 13	95 30.7	33 45.3	56.6	43 59.1	26.3	65 40.4	57.6	264 54.3	46.4
Y 14	110 33.2	48 44.6	57.3	58 59.7	26.7	80 42.4	57.8	279 56.8	46.4
15	125 35.6	63 43.9	57.9	74 00.3	27.2	95 44.4	57.9	294 59.3	46.4
16	140 38.1	78 43.2	58.6	89 00.9	27.7	110 46.4	58.1	310 01.7	46.4
17	155 40.6	93 42.5	59.2	104 01.6	28.2	125 48.3	58.3	325 04.2	46.4
18	170 43.0	108 41.8	N19 59.9	119 02.2	N18 28.6	140 50.3	N10 58.4	340 06.7	S 1 46.4
19	185 45.5	123 41.1	20 00.6	134 02.8	29.1	155 52.3	58.6	355 09.2	46.4
20	200 48.0	138 40.4	01.2	149 03.4	29.6	170 54.3	58.7	10 11.6	46.4
21	215 50.4	153 39.7	01.9	164 04.0	30.0	185 56.3	58.9	25 14.1	46.4
22	230 52.9	168 39.0	02.5	179 04.7	30.5	200 58.3	59.1	40 16.6	46.5
23	245 55.4	183 38.3	03.2	194 05.3	31.0	216 00.3	59.2	55 19.0	46.5
13 00	260 57.8	198 37.6	N20 03.8	209 05.9	N18 31.5	231 02.3	N10 59.4	70 21.5	S 1 46.5
01	276 00.3	213 36.9	04.5	224 06.5	31.9	246 04.3	59.6	85 24.0	46.5
02	291 02.7	228 36.2	05.1	239 07.2	32.4	261 06.3	59.7	100 26.4	46.5
03	306 05.2	243 35.5	05.8	254 07.8	32.9	276 08.3	10 59.9	115 28.9	46.5
04	321 07.7	258 34.8	06.4	269 08.4	33.3	291 10.3	11 00.0	130 31.4	46.5
05	336 10.1	273 34.0	07.1	284 09.0	33.8	306 12.3	00.2	145 33.8	46.5
06	351 12.6	288 33.3	N20 07.7	299 09.6	N18 34.3	321 14.3	N11 00.4	160 36.3	S 1 46.5
07	6 15.1	303 32.6	08.3	314 10.3	34.8	336 16.3	00.5	175 38.8	46.5
08	21 17.5	318 31.9	09.0	329 10.9	35.2	351 18.3	00.7	190 41.2	46.5
M 09	36 20.0	333 31.2	09.6	344 11.5	35.7	6 20.3	00.9	205 43.7	46.6
O 10	51 22.5	348 30.5	10.3	359 12.1	36.2	21 22.3	01.0	220 46.2	46.6
N 11	66 24.9	3 29.8	10.9	14 12.8	36.6	36 24.3	01.2	235 48.6	46.6
D 12	81 27.4	18 29.1	N20 11.5	29 13.4	N18 37.1	51 26.3	N11 01.3	250 51.1	S 1 46.6
A 13	96 29.9	33 28.4	12.2	44 14.0	37.6	66 28.3	01.5	265 53.6	46.6
Y 14	111 32.3	48 27.7	12.8	59 14.6	38.0	81 30.3	01.7	280 56.0	46.6
15	126 34.8	63 27.0	13.5	74 15.2	38.5	96 32.3	01.8	295 58.5	46.6
16	141 37.2	78 26.2	14.1	89 15.9	39.0	111 34.3	02.0	311 01.0	46.6
17	156 39.7	93 25.5	14.7	104 16.5	39.4	126 36.3	02.2	326 03.4	46.6
18	171 42.2	108 24.8	N20 15.4	119 17.1	N18 39.9	141 38.3	N11 02.3	341 05.9	S 1 46.6
19	186 44.6	123 24.1	16.0	134 17.7	40.4	156 40.3	02.5	356 08.4	46.7
20	201 47.1	138 23.4	16.6	149 18.4	40.8	171 42.3	02.6	11 10.8	46.7
21	216 49.6	153 22.7	17.3	164 19.0	41.3	186 44.3	02.8	26 13.3	46.7
22	231 52.0	168 22.0	17.9	179 19.6	41.7	201 46.3	03.0	41 15.8	46.7
23	246 54.5	183 21.2	18.5	194 20.2	42.2	216 48.3	03.1	56 18.2	46.7
14 00	261 57.0	198 20.5	N20 19.1	209 20.8	N18 42.7	231 50.3	N11 03.3	71 20.7	S 1 46.7
01	276 59.4	213 19.8	19.8	224 21.5	43.1	246 52.3	03.4	86 23.2	46.7
02	292 01.9	228 19.1	20.4	239 22.1	43.6	261 54.3	03.6	101 25.6	46.7
03	307 04.4	243 18.4	21.0	254 22.7	44.1	276 56.3	03.8	116 28.1	46.7
04	322 06.8	258 17.7	21.6	269 23.3	44.5	291 58.3	03.9	131 30.6	46.8
05	337 09.3	273 16.9	22.3	284 23.9	45.0	307 00.3	04.1	146 33.0	46.8
06	352 11.7	288 16.2	N20 22.9	299 24.6	N18 45.4	322 02.3	N11 04.2	161 35.5	S 1 46.8
07	7 14.2	303 15.5	23.5	314 25.2	45.9	337 04.3	04.4	176 38.0	46.8
T 08	22 16.7	318 14.8	24.1	329 25.8	46.4	352 06.3	04.6	191 40.4	46.8
U 09	37 19.1	333 14.1	24.7	344 26.4	46.8	7 08.3	04.7	206 42.9	46.8
E 10	52 21.6	348 13.3	25.4	359 27.0	47.3	22 10.3	04.9	221 45.3	46.8
S 11	67 24.1	3 12.6	26.0	14 27.7	47.8	37 12.3	05.1	236 47.8	46.8
D 12	82 26.5	18 11.9	N20 26.6	29 28.3	N18 48.2	52 14.3	N11 05.2	251 50.3	S 1 46.8
A 13	97 29.0	33 11.2	27.2	44 28.9	48.7	67 16.4	05.4	266 52.7	46.9
Y 14	112 31.5	48 10.5	27.8	59 29.5	49.1	82 18.4	05.5	281 55.2	46.9
15	127 33.9	63 09.7	28.4	74 30.1	49.6	97 20.4	05.7	296 57.7	46.9
16	142 36.4	78 09.0	29.1	89 30.8	50.0	112 22.4	05.9	312 00.1	46.9
17	157 38.9	93 08.3	29.7	104 31.4	50.5	127 24.4	06.0	327 02.6	46.9
18	172 41.3	108 07.6	N20 30.3	119 32.0	N18 51.0	142 26.4	N11 06.2	342 05.0	S 1 46.9
19	187 43.8	123 06.8	30.9	134 32.6	51.4	157 28.4	06.3	357 07.5	46.9
20	202 46.2	138 06.1	31.5	149 33.2	51.9	172 30.4	06.5	12 10.0	46.9
21	217 48.7	153 05.4	32.1	164 33.9	52.3	187 32.4	06.7	27 12.4	46.9
22	232 51.2	168 04.7	32.7	179 34.5	52.8	202 34.4	06.8	42 14.9	47.0
23	247 53.6	183 03.9	33.3	194 35.1	53.2	217 36.4	07.0	57 17.4	47.0
Mer. Pass.	h m 6 35.1	v −0.7	d 0.6	v 0.6	d 0.5	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.4
Achernar	335 28.1	S57 10.4
Acrux	173 10.8	S63 10.2
Adhara	255 14.0	S28 59.4
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.7	N55 54.0
Alkaid	152 59.7	N49 15.5
Al Na'ir	27 45.3	S46 54.0
Alnilam	275 48.2	S 1 11.8
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.6
Alpheratz	357 45.1	N29 09.1
Altair	62 09.4	N 8 54.0
Ankaa	353 17.2	S42 14.3
Antares	112 27.7	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.2	S69 02.9
Avior	234 19.1	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.5
Canopus	263 57.3	S52 42.2
Capella	280 37.1	N46 00.5
Deneb	49 32.2	N45 19.2
Denebola	182 35.1	N14 30.4
Diphda	348 57.4	S17 55.3
Dubhe	193 53.4	N61 41.5
Elnath	278 14.8	N28 36.9
Eltanin	90 46.3	N51 29.3
Enif	33 48.4	N 9 55.7
Fomalhaut	15 25.5	S29 33.4
Gacrux	172 02.4	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.6	S60 26.0
Hamal	328 02.6	N23 30.9
Kaus Aust.	83 45.3	S34 22.6
Kochab	137 18.9	N74 06.7
Markab	13 39.7	N15 16.0
Menkar	314 16.8	N 4 08.1
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.6	S69 46.2
Mirfak	308 42.9	N49 54.0
Nunki	75 59.7	S26 16.8
Peacock	53 21.0	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.4	N12 33.1
Regulus	207 45.2	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.4	N56 35.8
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.8	S43 29.1
Vega	80 39.5	N38 47.7
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	297 39.8	10 46
Mars	308 08.1	10 03
Jupiter	330 04.5	8 35
Saturn	169 23.7	19 15

UT	SUN			MOON					
	GHA		Dec	GHA	v	Dec	d	HP
d h	° ′		° ′	° ′	′	° ′	′	′
12 00	180 04.4		N23 06.8	53 56.6	7.8	S15 20.4	11.0	59.7
01	195 04.3		06.9	68 23.4	7.8	15 31.4	10.9	59.7
02	210 04.2		07.1	82 50.2	7.7	15 42.3	10.9	59.7
03	225 04.1	. .	07.2	97 16.9	7.7	15 53.2	10.7	59.7
04	240 03.9		07.4	111 43.6	7.6	16 03.9	10.6	59.7
05	255 03.8		07.6	126 10.2	7.5	16 14.5	10.6	59.7
06	270 03.7		N23 07.7	140 36.7	7.5	S16 25.1	10.4	59.7
07	285 03.6		07.9	155 03.2	7.4	16 35.5	10.3	59.7
08	300 03.4		08.1	169 29.6	7.4	16 45.8	10.3	59.7
S 09	315 03.3	. .	08.2	183 56.0	7.2	16 56.1	10.1	59.7
U 10	330 03.2		08.4	198 22.2	7.2	17 06.2	10.0	59.7
N 11	345 03.0		08.5	212 48.4	7.2	17 16.2	9.9	59.7
D 12	0 02.9		N23 08.7	227 14.6	7.1	S17 26.1	9.8	59.7
A 13	15 02.8		08.9	241 40.7	7.0	17 35.9	9.7	59.7
Y 14	30 02.7		09.0	256 06.7	6.9	17 45.6	9.5	59.7
15	45 02.5	. .	09.2	270 32.6	6.9	17 55.1	9.5	59.7
16	60 02.4		09.3	284 58.5	6.8	18 04.6	9.3	59.7
17	75 02.3		09.5	299 24.3	6.8	18 13.9	9.3	59.7
18	90 02.1		N23 09.6	313 50.1	6.7	S18 23.2	9.1	59.7
19	105 02.0		09.8	328 15.8	6.6	18 32.3	8.9	59.7
20	120 01.9		09.9	342 41.4	6.6	18 41.2	8.9	59.7
21	135 01.8	. .	10.1	357 07.0	6.5	18 50.1	8.7	59.7
22	150 01.6		10.2	11 32.5	6.5	18 58.8	8.7	59.7
23	165 01.5		10.4	25 58.0	6.4	19 07.5	8.5	59.7
13 00	180 01.4		N23 10.5	40 23.4	6.3	S19 16.0	8.3	59.6
01	195 01.2		10.7	54 48.7	6.3	19 24.3	8.3	59.6
02	210 01.1		10.8	69 14.0	6.2	19 32.6	8.1	59.6
03	225 01.0	. .	11.0	83 39.2	6.2	19 40.7	7.9	59.6
04	240 00.9		11.1	98 04.4	6.1	19 48.6	7.9	59.6
05	255 00.7		11.3	112 29.5	6.1	19 56.5	7.7	59.6
06	270 00.6		N23 11.4	126 54.6	6.0	S20 04.2	7.6	59.6
07	285 00.5		11.6	141 19.6	5.9	20 11.8	7.5	59.6
08	300 00.3		11.7	155 44.5	5.9	20 19.3	7.3	59.6
M 09	315 00.2	. .	11.9	170 09.4	5.9	20 26.6	7.2	59.6
O 10	330 00.1		12.0	184 34.3	5.8	20 33.8	7.0	59.6
N 11	345 00.0		12.2	198 59.1	5.7	20 40.8	6.9	59.6
D 12	359 59.8		N23 12.3	213 23.8	5.7	S20 47.7	6.8	59.6
A 13	14 59.7		12.4	227 48.5	5.7	20 54.5	6.6	59.5
Y 14	29 59.6		12.6	242 13.2	5.6	21 01.1	6.5	59.5
15	44 59.4	. .	12.7	256 37.8	5.6	21 07.6	6.3	59.5
16	59 59.3		12.9	271 02.4	5.5	21 13.9	6.2	59.5
17	74 59.2		13.0	285 26.9	5.5	21 20.1	6.1	59.5
18	89 59.0		N23 13.1	299 51.4	5.5	S21 26.2	5.9	59.5
19	104 58.9		13.3	314 15.9	5.4	21 32.1	5.7	59.5
20	119 58.8		13.4	328 40.3	5.4	21 37.8	5.7	59.5
21	134 58.7	. .	13.5	343 04.7	5.3	21 43.5	5.4	59.5
22	149 58.5		13.7	357 29.0	5.3	21 48.9	5.4	59.4
23	164 58.4		13.8	11 53.3	5.3	21 54.3	5.1	59.4
14 00	179 58.3		N23 13.9	26 17.6	5.2	S21 59.4	5.1	59.4
01	194 58.1		14.1	40 41.8	5.3	22 04.5	4.8	59.4
02	209 58.0		14.2	55 06.1	5.1	22 09.3	4.8	59.4
03	224 57.9	. .	14.3	69 30.2	5.2	22 14.1	4.5	59.4
04	239 57.7		14.5	83 54.4	5.2	22 18.6	4.5	59.4
05	254 57.6		14.6	98 18.6	5.1	22 23.1	4.2	59.3
06	269 57.5		N23 14.7	112 42.7	5.1	S22 27.3	4.1	59.3
07	284 57.3		14.8	127 06.8	5.1	22 31.4	4.0	59.3
T 08	299 57.2		15.0	141 30.9	5.0	22 35.4	3.8	59.3
U 09	314 57.1	. .	15.1	155 54.9	5.1	22 39.2	3.7	59.3
E 10	329 57.0		15.2	170 19.0	5.0	22 42.9	3.5	59.3
S 11	344 56.8		15.3	184 43.0	5.0	22 46.4	3.3	59.2
D 12	359 56.7		N23 15.5	199 07.0	5.0	S22 49.7	3.2	59.2
A 13	14 56.6		15.6	213 31.0	5.0	22 52.9	3.0	59.2
Y 14	29 56.4		15.7	227 55.0	5.0	22 55.9	2.9	59.2
15	44 56.3	. .	15.8	242 19.0	5.0	22 58.8	2.7	59.2
16	59 56.2		16.0	256 43.0	5.0	23 01.5	2.6	59.2
17	74 56.0		16.1	271 07.0	5.0	23 04.1	2.4	59.1
18	89 55.9		N23 16.2	285 31.0	5.0	S23 06.5	2.2	59.1
19	104 55.8		16.3	299 55.0	4.9	23 08.7	2.1	59.1
20	119 55.6		16.4	314 18.9	5.0	23 10.8	2.0	59.1
21	134 55.5	. .	16.6	328 42.9	5.0	23 12.8	1.7	59.1
22	149 55.4		16.7	343 06.9	5.0	23 14.5	1.7	59.0
23	164 55.3		16.8	357 30.9	5.1	S23 16.2	1.4	59.0
	SD 15.8		d 0.1	SD 16.3		16.2		16.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 12	Moonrise 13	Moonrise 14	Moonrise 15
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70				19 46			
68				18 54	21 56		
66				18 22	20 22	22 14	23 08
64	////	////	01 36	17 58	19 44	21 15	22 14
62	////	////	02 12	17 40	19 18	20 42	21 41
60	////	00 57	02 37	17 25	18 57	20 17	21 17
N 58	////	01 43	02 57	17 12	18 40	19 57	20 57
56	////	02 12	03 14	17 01	18 26	19 41	20 41
54	00 52	02 34	03 28	16 51	18 13	19 27	20 27
52	01 35	02 51	03 40	16 42	18 03	19 15	20 15
50	02 02	03 06	03 51	16 35	17 53	19 04	20 04
45	02 46	03 36	04 13	16 18	17 33	18 42	19 42
N 40	03 16	03 58	04 31	16 05	17 16	18 24	19 24
35	03 39	04 16	04 45	15 53	17 03	18 09	19 09
30	03 58	04 31	04 58	15 44	16 51	17 56	18 56
20	04 26	04 56	05 20	15 27	16 30	17 33	18 33
N 10	04 49	05 16	05 39	15 12	16 13	17 14	18 14
0	05 08	05 34	05 56	14 58	15 56	16 56	17 56
S 10	05 24	05 51	06 14	14 45	15 40	16 38	17 38
20	05 40	06 08	06 32	14 31	15 23	16 19	17 18
30	05 57	06 27	06 53	14 14	15 03	15 57	16 56
35	06 05	06 37	07 05	14 05	14 51	15 44	16 43
40	06 15	06 49	07 19	13 54	14 38	15 29	16 28
45	06 25	07 02	07 36	13 41	14 22	15 12	16 10
S 50	06 36	07 18	07 56	13 26	14 03	14 50	15 47
52	06 42	07 25	08 06	13 19	13 54	14 40	15 37
54	06 47	07 33	08 17	13 11	13 44	14 28	15 25
56	06 53	07 42	08 29	13 02	13 33	14 15	15 11
58	07 00	07 52	08 44	12 53	13 20	14 00	14 55
S 60	07 07	08 04	09 01	12 41	13 05	13 41	14 35

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 12	Moonset 13	Moonset 14	Moonset 15
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70				22 23			
68				23 16	22 17		
66				23 49	23 50	24 05	00 05
64	22 26	////	////	00 06	00 13	00 29	01 03
62	21 49	////	////	00 19	00 33	00 56	01 37
60	21 23	23 05	////	00 30	00 48	01 17	02 02
N 58	21 03	22 18	////	00 39	01 02	01 35	02 22
56	20 47	21 49	////	00 48	01 14	01 49	02 38
54	20 33	21 27	23 09	00 55	01 24	02 02	02 52
52	20 20	21 09	22 26	01 02	01 33	02 13	03 04
50	20 10	20 54	21 59	01 08	01 41	02 23	03 15
45	19 47	20 25	21 14	01 21	01 59	02 44	03 38
N 40	19 30	20 02	20 44	01 32	02 13	03 01	03 56
35	19 15	19 44	20 21	01 42	02 25	03 15	04 11
30	19 02	19 29	20 02	01 50	02 36	03 28	04 24
20	18 40	19 04	19 34	02 05	02 55	03 49	04 47
N 10	18 21	18 44	19 11	02 17	03 11	04 07	05 06
0	18 04	18 26	18 52	02 29	03 26	04 25	05 25
S 10	17 46	18 09	18 36	02 41	03 41	04 42	05 43
20	17 28	17 52	18 19	02 54	03 57	05 01	06 02
30	17 07	17 33	18 03	03 08	04 16	05 22	06 25
35	16 55	17 23	17 55	03 17	04 27	05 34	06 38
40	16 41	17 11	17 45	03 27	04 39	05 49	06 53
45	16 24	16 58	17 35	03 38	04 54	06 06	07 11
S 50	16 04	16 42	17 23	03 52	05 12	06 27	07 33
52	15 54	16 35	17 18	03 58	05 21	06 37	07 44
54	15 43	16 27	17 13	04 06	05 30	06 49	07 56
56	15 30	16 18	17 07	04 14	05 41	07 02	08 10
58	15 16	16 07	17 00	04 23	05 54	07 17	08 26
S 60	14 59	15 56	16 53	04 33	06 08	07 35	08 46

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
12	00 18	00 12	12 00	21 12	08 44	11	86
13	00 06	00 00	12 00	22 10	09 41	12	93
14	00 07	00 13	12 00	23 10	10 40	13	98

UT	ARIES	VENUS −3.8		MARS +1.4		JUPITER −2.2		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
15 00	262 56.1	198 03.2	N20 33.9	209 35.7	N18 53.7	232 38.4	N11 07.1	72 19.8	S 1 47.0
01	277 58.6	213 02.5	34.5	224 36.3	54.2	247 40.4	07.3	87 22.3	47.0
02	293 01.0	228 01.8	35.1	239 37.0	54.6	262 42.4	07.4	102 24.7	47.0
03	308 03.5	243 01.0	. . 35.7	254 37.6	. . 55.1	277 44.4	. . 07.6	117 27.2	. . 47.0
04	323 06.0	258 00.3	36.3	269 38.2	55.5	292 46.4	07.8	132 29.7	47.0
05	338 08.4	272 59.6	36.9	284 38.8	56.0	307 48.4	07.9	147 32.1	47.0
06	353 10.9	287 58.9	N20 37.5	299 39.4	N18 56.4	322 50.4	N11 08.1	162 34.6	S 1 47.1
W 07	8 13.4	302 58.1	38.1	314 40.1	56.9	337 52.4	08.2	177 37.0	47.1
E 08	23 15.8	317 57.4	38.7	329 40.7	57.3	352 54.4	08.4	192 39.5	47.1
D 09	38 18.3	332 56.7	. . 39.3	344 41.3	. . 57.8	7 56.4	. . 08.6	207 42.0	. . 47.1
N 10	53 20.7	347 55.9	39.9	359 41.9	58.2	22 58.4	08.7	222 44.4	47.1
E 11	68 23.2	2 55.2	40.5	14 42.5	58.7	38 00.5	08.9	237 46.9	47.1
S 12	83 25.7	17 54.5	N20 41.1	29 43.2	N18 59.1	53 02.5	N11 09.0	252 49.3	S 1 47.1
D 13	98 28.1	32 53.7	41.7	44 43.8	18 59.6	68 04.5	09.2	267 51.8	47.2
A 14	113 30.6	47 53.0	42.3	59 44.4	19 00.0	83 06.5	09.4	282 54.3	47.2
Y 15	128 33.1	62 52.3	. . 42.9	74 45.0	. . 00.5	98 08.5	. . 09.5	297 56.7	. . 47.2
16	143 35.5	77 51.5	43.5	89 45.6	01.0	113 10.5	09.7	312 59.2	47.2
17	158 38.0	92 50.8	44.1	104 46.2	01.4	128 12.5	09.8	328 01.6	47.2
18	173 40.5	107 50.1	N20 44.7	119 46.9	N19 01.9	143 14.5	N11 10.0	343 04.1	S 1 47.2
19	188 42.9	122 49.3	45.2	134 47.5	02.3	158 16.5	10.1	358 06.5	47.2
20	203 45.4	137 48.6	45.8	149 48.1	02.7	173 18.5	10.3	13 09.0	47.2
21	218 47.8	152 47.9	. . 46.4	164 48.7	. . 03.2	188 20.5	. . 10.5	28 11.5	. . 47.3
22	233 50.3	167 47.1	47.0	179 49.3	03.6	203 22.5	10.6	43 13.9	47.3
23	248 52.8	182 46.4	47.6	194 50.0	04.1	218 24.5	10.8	58 16.4	47.3
16 00	263 55.2	197 45.7	N20 48.2	209 50.6	N19 04.5	233 26.5	N11 10.9	73 18.8	S 1 47.3
01	278 57.7	212 44.9	48.7	224 51.2	05.0	248 28.6	11.1	88 21.3	47.3
02	294 00.2	227 44.2	49.3	239 51.8	05.4	263 30.6	11.3	103 23.7	47.3
03	309 02.6	242 43.4	. . 49.9	254 52.4	. . 05.9	278 32.6	. . 11.4	118 26.2	. . 47.3
04	324 05.1	257 42.7	50.5	269 53.0	06.3	293 34.6	11.6	133 28.7	47.4
05	339 07.6	272 42.0	51.1	284 53.7	06.8	308 36.6	11.7	148 31.1	47.4
06	354 10.0	287 41.2	N20 51.6	299 54.3	N19 07.2	323 38.6	N11 11.9	163 33.6	S 1 47.4
07	9 12.5	302 40.5	52.2	314 54.9	07.7	338 40.6	12.0	178 36.0	47.4
T 08	24 15.0	317 39.8	52.8	329 55.5	08.1	353 42.6	12.2	193 38.5	47.4
H 09	39 17.4	332 39.0	. . 53.4	344 56.1	. . 08.6	8 44.6	. . 12.4	208 40.9	. . 47.4
U 10	54 19.9	347 38.3	53.9	359 56.8	09.0	23 46.6	12.5	223 43.4	47.4
R 11	69 22.3	2 37.5	54.5	14 57.4	09.4	38 48.6	12.7	238 45.9	47.5
S 12	84 24.8	17 36.8	N20 55.1	29 58.0	N19 09.9	53 50.6	N11 12.8	253 48.3	S 1 47.5
D 13	99 27.3	32 36.0	55.6	44 58.6	10.3	68 52.7	13.0	268 50.8	47.5
A 14	114 29.7	47 35.3	56.2	59 59.2	10.8	83 54.7	13.1	283 53.2	47.5
Y 15	129 32.2	62 34.6	. . 56.8	74 59.8	. . 11.2	98 56.7	. . 13.3	298 55.7	. . 47.5
16	144 34.7	77 33.8	57.3	90 00.5	11.7	113 58.7	13.5	313 58.1	47.5
17	159 37.1	92 33.1	57.9	105 01.1	12.1	129 00.7	13.6	329 00.6	47.6
18	174 39.6	107 32.3	N20 58.5	120 01.7	N19 12.5	144 02.7	N11 13.8	344 03.0	S 1 47.6
19	189 42.1	122 31.6	59.0	135 02.3	13.0	159 04.7	13.9	359 05.5	47.6
20	204 44.5	137 30.8	20 59.6	150 02.9	13.4	174 06.7	14.1	14 07.9	47.6
21	219 47.0	152 30.1	21 00.2	165 03.5	. . 13.9	189 08.7	. . 14.2	29 10.4	. . 47.6
22	234 49.5	167 29.3	00.7	180 04.2	14.3	204 10.7	14.4	44 12.9	47.6
23	249 51.9	182 28.6	01.3	195 04.8	14.8	219 12.8	14.5	59 15.3	47.6
17 00	264 54.4	197 27.8	N21 01.8	210 05.4	N19 15.2	234 14.8	N11 14.7	74 17.8	S 1 47.7
01	279 56.8	212 27.1	02.4	225 06.0	15.6	249 16.8	14.9	89 20.2	47.7
02	294 59.3	227 26.4	02.9	240 06.6	16.1	264 18.8	15.0	104 22.7	47.7
03	310 01.8	242 25.6	. . 03.5	255 07.2	. . 16.5	279 20.8	. . 15.2	119 25.1	. . 47.7
04	325 04.2	257 24.9	04.1	270 07.9	16.9	294 22.8	15.3	134 27.6	47.7
05	340 06.7	272 24.1	04.6	285 08.5	17.4	309 24.8	15.5	149 30.0	47.7
06	355 09.2	287 23.4	N21 05.2	300 09.1	N19 17.8	324 26.8	N11 15.6	164 32.5	S 1 47.8
07	10 11.6	302 22.6	05.7	315 09.7	18.3	339 28.9	15.8	179 34.9	47.8
08	25 14.1	317 21.9	06.3	330 10.3	18.7	354 30.9	16.0	194 37.4	47.8
F 09	40 16.6	332 21.1	. . 06.8	345 10.9	. . 19.1	9 32.9	. . 16.1	209 39.8	. . 47.8
R 10	55 19.0	347 20.4	07.4	0 11.6	19.6	24 34.9	16.3	224 42.3	47.8
I 11	70 21.5	2 19.6	07.9	15 12.2	20.0	39 36.9	16.4	239 44.7	47.8
D 12	85 24.0	17 18.8	N21 08.5	30 12.8	N19 20.4	54 38.9	N11 16.6	254 47.2	S 1 47.9
A 13	100 26.4	32 18.1	09.0	45 13.4	20.9	69 40.9	16.7	269 49.6	47.9
Y 14	115 28.9	47 17.3	09.5	60 14.0	21.3	84 42.9	16.9	284 52.1	47.9
15	130 31.3	62 16.6	. . 10.1	75 14.6	. . 21.8	99 45.0	. . 17.0	299 54.5	. . 47.9
16	145 33.8	77 15.8	10.6	90 15.2	22.2	114 47.0	17.2	314 57.0	47.9
17	160 36.3	92 15.1	11.2	105 15.9	22.6	129 49.0	17.3	329 59.4	47.9
18	175 38.7	107 14.3	N21 11.7	120 16.5	N19 23.1	144 51.0	N11 17.5	345 01.9	S 1 48.0
19	190 41.2	122 13.6	12.3	135 17.1	23.5	159 53.0	17.7	0 04.3	48.0
20	205 43.7	137 12.8	12.8	150 17.7	23.9	174 55.0	17.8	15 06.8	48.0
21	220 46.1	152 12.1	. . 13.3	165 18.3	. . 24.4	189 57.0	. . 18.0	30 09.3	. . 48.0
22	235 48.6	167 11.3	13.9	180 18.9	24.8	204 59.1	18.1	45 11.7	48.0
23	250 51.1	182 10.5	14.4	195 19.6	25.2	220 01.1	18.3	60 14.2	48.0
	h m								
Mer. Pass.	6 23.3	v −0.7	d 0.6	v 0.6	d 0.4	v 2.0	d 0.2	v 2.5	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.4
Achernar	335 28.1	S57 10.4
Acrux	173 10.8	S63 10.2
Adhara	255 14.0	S28 59.4
Aldebaran	290 51.4	N16 31.9
Alioth	166 21.7	N55 54.0
Alkaid	152 59.7	N49 15.5
Al Na'ir	27 45.3	S46 54.0
Alnilam	275 48.1	S 1 11.8
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.6
Alpheratz	357 45.0	N29 09.2
Altair	62 09.3	N 8 54.0
Ankaa	353 17.1	S42 14.3
Antares	112 27.6	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.2	S69 02.9
Avior	234 19.1	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.5
Canopus	263 57.3	S52 42.2
Capella	280 37.0	N46 00.5
Deneb	49 32.1	N45 19.2
Denebola	182 35.1	N14 30.4
Diphda	348 57.4	S17 55.2
Dubhe	193 53.5	N61 41.5
Elnath	278 14.8	N28 36.9
Eltanin	90 46.3	N51 29.3
Enif	33 48.4	N 9 55.7
Fomalhaut	15 25.4	S29 33.4
Gacrux	172 02.4	S57 11.0
Gienah	175 53.7	S17 36.6
Hadar	148 49.6	S60 26.0
Hamal	328 02.6	N23 30.9
Kaus Aust.	83 45.3	S34 22.6
Kochab	137 18.9	N74 06.7
Markab	13 39.7	N15 16.0
Menkar	314 16.8	N 4 08.1
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.7	S69 46.2
Mirfak	308 42.9	N49 54.0
Nunki	75 59.7	S26 16.8
Peacock	53 21.0	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.4	N12 33.2
Regulus	207 45.2	N11 54.6
Rigel	281 13.8	S 8 11.4
Rigil Kent.	139 53.2	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.4	N56 35.8
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.8	S43 29.0
Vega	80 39.5	N38 47.7
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	293 50.4	10 49
Mars	305 55.3	10 00
Jupiter	329 31.3	8 25
Saturn	169 23.6	19 04

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
15 00	179 55.1	N23 16.9	11 55.0	5.0	S23 17.6	1.3	59.0
01	194 55.0	17.0	26 19.0	5.0	23 18.9	1.2	59.0
02	209 54.9	17.1	40 43.0	5.1	23 20.1	1.0	59.0
03	224 54.7	17.3	55 07.1	5.1	23 21.1	0.8	58.9
04	239 54.6	17.4	69 31.2	5.1	23 21.9	0.7	58.9
05	254 54.5	17.5	83 55.3	5.1	23 22.6	0.5	58.9
06	269 54.3	N23 17.6	98 19.4	5.1	S23 23.1	0.4	58.9
W 07	284 54.2	17.7	112 43.5	5.2	23 23.5	0.2	58.9
E 08	299 54.1	17.8	127 07.7	5.2	23 23.7	0.0	58.8
D 09	314 53.9	17.9	141 31.9	5.2	23 23.7	0.1	58.8
N 10	329 53.8	18.0	155 56.1	5.2	23 23.6	0.2	58.8
E 11	344 53.7	18.1	170 20.3	5.3	23 23.4	0.4	58.8
S 12	359 53.5	N23 18.2	184 44.6	5.3	S23 23.0	0.6	58.7
D 13	14 53.4	18.4	199 08.9	5.4	23 22.4	0.7	58.7
A 14	29 53.3	18.5	213 33.3	5.4	23 21.7	0.9	58.7
Y 15	44 53.1	18.6	227 57.7	5.4	23 20.8	1.0	58.7
16	59 53.0	18.7	242 22.1	5.5	23 19.8	1.2	58.7
17	74 52.9	18.8	256 46.6	5.5	23 18.6	1.3	58.6
18	89 52.7	N23 18.9	271 11.1	5.6	S23 17.3	1.5	58.6
19	104 52.6	19.0	285 35.7	5.6	23 15.8	1.6	58.6
20	119 52.5	19.1	300 00.3	5.6	23 14.2	1.8	58.6
21	134 52.3	19.2	314 24.9	5.7	23 12.4	1.9	58.5
22	149 52.2	19.3	328 49.6	5.8	23 10.5	2.0	58.5
23	164 52.1	19.4	343 14.4	5.8	23 08.5	2.3	58.5
16 00	179 51.9	N23 19.5	357 39.2	5.9	S23 06.2	2.3	58.5
01	194 51.8	19.6	12 04.1	5.9	23 03.9	2.5	58.4
02	209 51.7	19.7	26 29.0	6.0	23 01.4	2.7	58.4
03	224 51.5	19.8	40 54.0	6.0	22 58.7	2.8	58.4
04	239 51.4	19.9	55 19.0	6.1	22 55.9	2.9	58.3
05	254 51.3	20.0	69 44.1	6.2	22 53.0	3.1	58.3
06	269 51.1	N23 20.1	84 09.3	6.2	S22 49.9	3.3	58.3
T 07	284 51.0	20.2	98 34.5	6.3	22 46.6	3.3	58.3
H 08	299 50.9	20.2	112 59.8	6.3	22 43.3	3.5	58.2
U 09	314 50.7	20.3	127 25.1	6.4	22 39.8	3.7	58.2
R 10	329 50.6	20.4	141 50.5	6.5	22 36.1	3.8	58.2
S 11	344 50.5	20.5	156 16.0	6.6	22 32.3	3.9	58.2
D 12	359 50.3	N23 20.6	170 41.6	6.6	S22 28.4	4.0	58.1
A 13	14 50.2	20.7	185 07.2	6.7	22 24.4	4.2	58.1
Y 14	29 50.1	20.8	199 32.9	6.8	22 20.2	4.4	58.1
15	44 49.9	20.9	213 58.7	6.9	22 15.8	4.4	58.0
16	59 49.8	21.0	228 24.6	6.9	22 11.4	4.6	58.0
17	74 49.7	21.0	242 50.5	7.0	22 06.8	4.7	58.0
18	89 49.5	N23 21.1	257 16.5	7.1	S22 02.1	4.9	58.0
19	104 49.4	21.2	271 42.6	7.2	21 57.2	5.0	57.9
20	119 49.3	21.3	286 08.8	7.2	21 52.2	5.1	57.9
21	134 49.1	21.4	300 35.0	7.3	21 47.1	5.2	57.9
22	149 49.0	21.5	315 01.3	7.4	21 41.9	5.4	57.8
23	164 48.9	21.6	329 27.7	7.5	21 36.5	5.4	57.8
17 00	179 48.7	N23 21.6	343 54.2	7.6	S21 31.1	5.6	57.8
01	194 48.6	21.7	358 20.8	7.7	21 25.5	5.8	57.8
02	209 48.5	21.8	12 47.5	7.7	21 19.7	5.8	57.7
03	224 48.3	21.9	27 14.2	7.8	21 13.9	6.0	57.7
04	239 48.2	22.0	41 41.0	8.0	21 07.9	6.0	57.7
05	254 48.1	22.0	56 08.0	8.0	21 01.9	6.2	57.6
06	269 47.9	N23 22.1	70 35.0	8.0	S20 55.7	6.3	57.6
07	284 47.8	22.2	85 02.0	8.2	20 49.4	6.5	57.6
08	299 47.7	22.3	99 29.2	8.3	20 42.9	6.5	57.6
F 09	314 47.5	22.3	113 56.5	8.3	20 36.4	6.6	57.5
R 10	329 47.4	22.4	128 23.8	8.5	20 29.8	6.8	57.5
I 11	344 47.3	22.5	142 51.3	8.5	20 23.0	6.9	57.5
D 12	359 47.1	N23 22.6	157 18.8	8.6	S20 16.1	6.9	57.4
A 13	14 47.0	22.6	171 46.4	8.8	20 09.2	7.1	57.4
Y 14	29 46.9	22.7	186 14.2	8.8	20 02.1	7.2	57.4
15	44 46.7	22.8	200 42.0	8.9	19 54.9	7.3	57.3
16	59 46.6	22.8	215 09.9	8.9	19 47.6	7.4	57.3
17	74 46.5	22.9	229 37.8	9.1	19 40.2	7.5	57.3
18	89 46.3	N23 23.0	244 05.9	9.2	S19 32.7	7.6	57.2
19	104 46.2	23.1	258 34.1	9.3	19 25.1	7.6	57.2
20	119 46.1	23.1	273 02.4	9.3	19 17.5	7.8	57.2
21	134 45.9	23.2	287 30.7	9.5	19 09.7	7.9	57.2
22	149 45.8	23.3	301 59.2	9.5	19 01.8	8.0	57.1
23	164 45.7	23.3	316 27.7	9.7	S18 53.8	8.1	57.1
	SD 15.8	d 0.1	SD 16.0		15.8		15.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 15	Moonrise 16	Moonrise 17	Moonrise 18
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	▬	▬	▬	▬
N 70	▭	▭	▭	▬	▬	▬	(00 35 / 23 59)
68	▭	▭	▭	▬	▬	(00 20 / 23 48)	23 34
66	▭	▭	▭	23 08	23 17	23 17	23 16
64	////	////	01 33	22 14	22 41	22 54	23 00
62	////	////	02 10	21 41	22 16	22 36	22 48
60	////	00 52	02 36	21 17	21 56	22 20	22 37
N 58	////	01 41	02 56	20 57	21 39	22 07	22 27
56	////	02 11	03 13	20 41	21 25	21 56	22 19
54	00 48	02 33	03 27	20 27	21 13	21 46	22 11
52	01 33	02 51	03 39	20 15	21 02	21 37	22 05
50	02 00	03 06	03 50	20 04	20 52	21 29	21 58
45	02 46	03 35	04 13	19 42	20 32	21 12	21 45
N 40	03 16	03 58	04 31	19 24	20 15	20 58	21 34
35	03 39	04 16	04 46	19 09	20 02	20 47	21 25
30	03 58	04 31	04 59	18 56	19 49	20 36	21 17
20	04 27	04 56	05 21	18 33	19 29	20 18	21 03
N 10	04 49	05 16	05 39	18 14	19 10	20 03	20 50
0	05 08	05 34	05 57	17 56	18 53	19 48	20 39
S 10	05 25	05 52	06 14	17 38	18 37	19 33	20 27
20	05 41	06 09	06 33	17 18	18 18	19 17	20 14
30	05 58	06 28	06 54	16 56	17 57	18 59	20 00
35	06 06	06 38	07 06	16 43	17 45	18 49	19 51
40	06 16	06 50	07 20	16 28	17 31	18 37	19 42
45	06 26	07 03	07 37	16 10	17 14	18 22	19 31
S 50	06 38	07 19	07 58	15 47	16 54	18 05	19 17
52	06 43	07 27	08 08	15 37	16 44	17 56	19 10
54	06 49	07 35	08 19	15 25	16 32	17 47	19 03
56	06 55	07 44	08 31	15 11	16 20	17 36	18 55
58	07 02	07 54	08 46	14 55	16 05	17 24	18 46
S 60	07 09	08 06	09 03	14 35	15 48	17 10	18 36

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 15	Moonset 16	Moonset 17	Moonset 18
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	▬	▬	▬	▬
N 70	▭	▭	▭	▬	▬	▬	03 40
68	▭	▭	▭	▬	▬	02 02	04 26
66	▭	▭	▭	00 05	01 15	03 06	04 56
64	22 29	////	////	01 03	02 09	03 40	05 18
62	21 52	////	////	01 37	02 42	04 05	05 36
60	21 26	23 10	////	02 02	03 06	04 25	05 51
N 58	21 05	22 21	////	02 22	03 25	04 41	06 03
56	20 49	21 51	////	02 38	03 41	04 55	06 14
54	20 34	21 29	23 15	02 52	03 55	05 07	06 23
52	20 22	21 11	22 29	03 04	04 07	05 17	06 31
50	20 11	20 56	22 01	03 15	04 17	05 27	06 39
45	19 49	20 26	21 16	03 38	04 39	05 46	06 55
N 40	19 31	20 04	20 45	03 56	04 57	06 02	07 08
35	19 16	19 45	20 22	04 11	05 12	06 15	07 19
30	19 03	19 30	20 04	04 24	05 25	06 27	07 29
20	18 41	19 05	19 35	04 47	05 47	06 47	07 45
N 10	18 22	18 45	19 12	05 06	06 06	07 04	07 59
0	18 04	18 27	18 53	05 25	06 24	07 20	08 13
S 10	17 47	18 10	18 36	05 43	06 41	07 36	08 26
20	17 28	17 52	18 20	06 02	07 00	07 53	08 40
30	17 07	17 34	18 03	06 25	07 22	08 12	08 56
35	16 55	17 23	17 55	06 38	07 35	08 23	09 05
40	16 41	17 11	17 45	06 53	07 49	08 36	09 16
45	16 24	16 58	17 35	07 11	08 06	08 51	09 28
S 50	16 03	16 42	17 23	07 33	08 28	09 10	09 43
52	15 54	16 34	17 18	07 44	08 38	09 19	09 50
54	15 42	16 26	17 12	07 56	08 49	09 28	09 58
56	15 30	16 17	17 06	08 10	09 02	09 39	10 06
58	15 15	16 07	17 00	08 26	09 17	09 52	10 16
S 60	14 58	15 55	16 52	08 46	09 35	10 06	10 27

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
15	00 19	00 26	12 00	24 10	11 40	14	100
16	00 32	00 38	12 01	00 10	12 39	15	99
17	00 45	00 51	12 01	01 07	13 34	16	97

UT	ARIES	VENUS −3.8		MARS +1.4		JUPITER −2.2		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
18 00	265 53.5	197 09.8	N21 14.9	210 20.2	N19 25.7	235 03.1	N11 18.4	75 16.6	S 1 48.1
01	280 56.0	212 09.0	15.5	225 20.8	26.1	250 05.1	18.6	90 19.0	48.1
02	295 58.5	227 08.3	16.0	240 21.4	26.5	265 07.1	18.7	105 21.5	48.1
03	311 00.9	242 07.5	16.5	255 22.0	26.9	280 09.1	18.9	120 23.9	48.1
04	326 03.4	257 06.8	17.1	270 22.6	27.4	295 11.1	19.0	135 26.4	48.1
05	341 05.8	272 06.0	17.6	285 23.2	27.8	310 13.2	19.2	150 28.8	48.1
06	356 08.3	287 05.2	N21 18.1	300 23.9	N19 28.2	325 15.2	N11 19.4	165 31.3	S 1 48.2
07	11 10.8	302 04.5	18.6	315 24.5	28.7	340 17.2	19.5	180 33.7	48.2
S 08	26 13.2	317 03.7	19.2	330 25.1	29.1	355 19.2	19.7	195 36.2	48.2
A 09	41 15.7	332 03.0	19.7	345 25.7	29.5	10 21.2	19.8	210 38.6	48.2
T 10	56 18.2	347 02.2	20.2	0 26.3	30.0	25 23.2	20.0	225 41.1	48.2
U 11	71 20.6	2 01.4	20.7	15 26.9	30.4	40 25.3	20.1	240 43.5	48.3
R 12	86 23.1	17 00.7	N21 21.3	30 27.5	N19 30.8	55 27.3	N11 20.3	255 46.0	S 1 48.3
D 13	101 25.6	31 59.9	21.8	45 28.2	31.2	70 29.3	20.4	270 48.4	48.3
A 14	116 28.0	46 59.1	22.3	60 28.8	31.7	85 31.3	20.6	285 50.9	48.3
Y 15	131 30.5	61 58.4	22.8	75 29.4	32.1	100 33.3	20.7	300 53.3	48.3
16	146 33.0	76 57.6	23.3	90 30.0	32.5	115 35.3	20.9	315 55.8	48.3
17	161 35.4	91 56.9	23.9	105 30.6	32.9	130 37.4	21.0	330 58.2	48.4
18	176 37.9	106 56.1	N21 24.4	120 31.2	N19 33.4	145 39.4	N11 21.2	346 00.7	S 1 48.4
19	191 40.3	121 55.3	24.9	135 31.8	33.8	160 41.4	21.4	1 03.1	48.4
20	206 42.8	136 54.6	25.4	150 32.5	34.2	175 43.4	21.5	16 05.6	48.4
21	221 45.3	151 53.8	25.9	165 33.1	34.6	190 45.4	21.7	31 08.0	48.4
22	236 47.7	166 53.0	26.4	180 33.7	35.1	205 47.4	21.8	46 10.5	48.5
23	251 50.2	181 52.3	26.9	195 34.3	35.5	220 49.5	22.0	61 12.9	48.5
19 00	266 52.7	196 51.5	N21 27.5	210 34.9	N19 35.9	235 51.5	N11 22.1	76 15.3	S 1 48.5
01	281 55.1	211 50.7	28.0	225 35.5	36.3	250 53.5	22.3	91 17.8	48.5
02	296 57.6	226 50.0	28.5	240 36.1	36.8	265 55.5	22.4	106 20.2	48.5
03	312 00.1	241 49.2	29.0	255 36.8	37.2	280 57.5	22.6	121 22.7	48.6
04	327 02.5	256 48.4	29.5	270 37.4	37.6	295 59.6	22.7	136 25.1	48.6
05	342 05.0	271 47.6	30.0	285 38.0	38.0	311 01.6	22.9	151 27.6	48.6
06	357 07.4	286 46.9	N21 30.5	300 38.6	N19 38.5	326 03.6	N11 23.0	166 30.0	S 1 48.6
07	12 09.9	301 46.1	31.0	315 39.2	38.9	341 05.6	23.2	181 32.5	48.6
08	27 12.4	316 45.3	31.5	330 39.8	39.3	356 07.6	23.3	196 34.9	48.7
S 09	42 14.8	331 44.6	32.0	345 40.4	39.7	11 09.6	23.5	211 37.3	48.7
U 10	57 17.3	346 43.8	32.5	0 41.0	40.1	26 11.7	23.6	226 39.8	48.7
N 11	72 19.8	1 43.0	33.0	15 41.7	40.6	41 13.7	23.8	241 42.2	48.7
D 12	87 22.2	16 42.2	N21 33.5	30 42.3	N19 41.0	56 15.7	N11 23.9	256 44.7	S 1 48.7
A 13	102 24.7	31 41.5	34.0	45 42.9	41.4	71 17.7	24.1	271 47.1	48.8
Y 14	117 27.2	46 40.7	34.5	60 43.5	41.8	86 19.7	24.2	286 49.6	48.8
15	132 29.6	61 39.9	35.0	75 44.1	42.2	101 21.8	24.4	301 52.0	48.8
16	147 32.1	76 39.2	35.5	90 44.7	42.7	116 23.8	24.6	316 54.5	48.8
17	162 34.6	91 38.4	36.0	105 45.3	43.1	131 25.8	24.7	331 56.9	48.8
18	177 37.0	106 37.6	N21 36.5	120 45.9	N19 43.5	146 27.8	N11 24.9	346 59.3	S 1 48.9
19	192 39.5	121 36.8	36.9	135 46.6	43.9	161 29.8	25.0	2 01.8	48.9
20	207 41.9	136 36.1	37.4	150 47.2	44.3	176 31.9	25.2	17 04.2	48.9
21	222 44.4	151 35.3	37.9	165 47.8	44.7	191 33.9	25.3	32 06.7	48.9
22	237 46.9	166 34.5	38.4	180 48.4	45.2	206 35.9	25.5	47 09.1	48.9
23	252 49.3	181 33.7	38.9	195 49.0	45.6	221 37.9	25.6	62 11.6	49.0
20 00	267 51.8	196 33.0	N21 39.4	210 49.6	N19 46.0	236 40.0	N11 25.8	77 14.0	S 1 49.0
01	282 54.3	211 32.2	39.9	225 50.2	46.4	251 42.0	25.9	92 16.4	49.0
02	297 56.7	226 31.4	40.3	240 50.8	46.8	266 44.0	26.1	107 18.9	49.0
03	312 59.2	241 30.6	40.8	255 51.5	47.2	281 46.0	26.2	122 21.3	49.0
04	328 01.7	256 29.8	41.3	270 52.1	47.7	296 48.0	26.4	137 23.8	49.1
05	343 04.1	271 29.1	41.8	285 52.7	48.1	311 50.1	26.5	152 26.2	49.1
06	358 06.6	286 28.3	N21 42.3	300 53.3	N19 48.5	326 52.1	N11 26.7	167 28.6	S 1 49.1
07	13 09.1	301 27.5	42.7	315 53.9	48.9	341 54.1	26.8	182 31.1	49.1
08	28 11.5	316 26.7	43.2	330 54.5	49.3	356 56.1	27.0	197 33.5	49.1
M 09	43 14.0	331 25.9	43.7	345 55.1	49.7	11 58.2	27.1	212 36.0	49.2
O 10	58 16.4	346 25.2	44.2	0 55.7	50.1	27 00.2	27.3	227 38.4	49.2
N 11	73 18.9	1 24.4	44.7	15 56.4	50.5	42 02.2	27.4	242 40.8	49.2
D 12	88 21.4	16 23.6	N21 45.1	30 57.0	N19 51.0	57 04.2	N11 27.6	257 43.3	S 1 49.2
A 13	103 23.8	31 22.8	45.6	45 57.6	51.4	72 06.3	27.7	272 45.7	49.2
Y 14	118 26.3	46 22.0	46.1	60 58.2	51.8	87 08.3	27.9	287 48.2	49.3
15	133 28.8	61 21.3	46.5	75 58.8	52.2	102 10.3	28.0	302 50.6	49.3
16	148 31.2	76 20.5	47.0	90 59.4	52.6	117 12.3	28.2	317 53.0	49.3
17	163 33.7	91 19.7	47.5	106 00.0	53.0	132 14.3	28.3	332 55.5	49.3
18	178 36.2	106 18.9	N21 47.9	121 00.6	N19 53.4	147 16.4	N11 28.5	347 57.9	S 1 49.4
19	193 38.6	121 18.1	48.4	136 01.2	53.8	162 18.4	28.6	3 00.4	49.4
20	208 41.1	136 17.3	48.9	151 01.9	54.2	177 20.4	28.8	18 02.8	49.4
21	223 43.5	151 16.5	49.3	166 02.5	54.6	192 22.4	28.9	33 05.2	49.4
22	238 46.0	166 15.8	49.8	181 03.1	55.1	207 24.5	29.1	48 07.7	49.4
23	253 48.5	181 15.0	50.3	196 03.7	55.5	222 26.5	29.2	63 10.1	49.5
	h m								
Mer. Pass.	6 11.5	v −0.8	d 0.5	v 0.6	d 0.4	v 2.0	d 0.2	v 2.4	d 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.3
Achernar	335 28.0	S57 10.4
Acrux	173 10.8	S63 10.2
Adhara	255 14.0	S28 59.4
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.7	N55 54.0
Alkaid	152 59.7	N49 15.5
Al Na'ir	27 45.2	S46 54.0
Alnilam	275 48.1	S 1 11.7
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.6
Alpheratz	357 45.0	N29 09.2
Altair	62 09.3	N 8 54.0
Ankaa	353 17.1	S42 14.3
Antares	112 27.6	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.2	S69 02.9
Avior	234 19.2	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.5
Canopus	263 57.3	S52 42.2
Capella	280 37.0	N46 00.5
Deneb	49 32.1	N45 19.2
Denebola	182 35.1	N14 30.4
Diphda	348 57.4	S17 55.2
Dubhe	193 53.5	N61 41.5
Elnath	278 14.8	N28 36.9
Eltanin	90 46.2	N51 29.3
Enif	33 48.3	N 9 55.7
Fomalhaut	15 25.4	S29 33.4
Gacrux	172 02.4	S57 11.0
Gienah	175 53.7	S17 36.5
Hadar	148 49.6	S60 26.0
Hamal	328 02.6	N23 30.9
Kaus Aust.	83 45.3	S34 22.6
Kochab	137 19.0	N74 06.7
Markab	13 39.7	N15 16.1
Menkar	314 16.8	N 4 08.1
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.7	S69 46.2
Mirfak	308 42.8	N49 54.0
Nunki	75 59.7	S26 16.8
Peacock	53 20.9	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.4	N12 33.2
Regulus	207 45.2	N11 54.6
Rigel	281 13.7	S 8 11.3
Rigil Kent.	139 53.3	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.3	N56 35.8
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.8	S43 29.0
Vega	80 39.5	N38 47.7
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	289 58.8	10 53
Mars	303 42.2	9 57
Jupiter	328 58.8	8 15
Saturn	169 22.7	18 52

UT	SUN			MOON					
	GHA		Dec	GHA	v		Dec	d	HP
d h	° ′		° ′	° ′	′		° ′	′	′
18 00	179 45.5		N23 23.4	330 56.4	9.7		S18 45.7	8.1	57.1
01	194 45.4		23.4	345 25.1	9.8		18 37.6	8.3	57.0
02	209 45.3		23.5	359 53.9	9.9		18 29.3	8.3	57.0
03	224 45.1	. .	23.6	14 22.8	10.0		18 21.0	8.4	57.0
04	239 45.0		23.6	28 51.8	10.1		18 12.6	8.6	56.9
05	254 44.8		23.7	43 20.9	10.2		18 04.0	8.6	56.9
06	269 44.7		N23 23.8	57 50.1	10.3		S17 55.4	8.6	56.9
07	284 44.6		23.8	72 19.4	10.4		17 46.8	8.8	56.9
S 08	299 44.4		23.9	86 48.8	10.4		17 38.0	8.9	56.8
A 09	314 44.3	. .	23.9	101 18.2	10.6		17 29.1	8.9	56.8
T 10	329 44.2		24.0	115 47.8	10.6		17 20.2	9.0	56.8
U 11	344 44.0		24.0	130 17.4	10.8		17 11.2	9.1	56.7
R 12	359 43.9		N23 24.1	144 47.2	10.8		S17 02.1	9.1	56.7
D 13	14 43.8		24.2	159 17.0	10.9		16 53.0	9.3	56.7
A 14	29 43.6		24.2	173 46.9	11.0		16 43.7	9.3	56.6
Y 15	44 43.5	. .	24.3	188 16.9	11.1		16 34.4	9.4	56.6
16	59 43.4		24.3	202 47.0	11.2		16 25.0	9.4	56.6
17	74 43.2		24.4	217 17.2	11.3		16 15.6	9.6	56.5
18	89 43.1		N23 24.4	231 47.5	11.3		S16 06.0	9.6	56.5
19	104 43.0		24.5	246 17.8	11.5		15 56.4	9.6	56.5
20	119 42.8		24.5	260 48.3	11.5		15 46.8	9.8	56.5
21	134 42.7	. .	24.6	275 18.8	11.6		15 37.0	9.8	56.4
22	149 42.6		24.6	289 49.4	11.7		15 27.2	9.8	56.4
23	164 42.4		24.7	304 20.1	11.8		15 17.4	9.9	56.4
19 00	179 42.3		N23 24.7	318 50.9	11.9		S15 07.5	10.0	56.3
01	194 42.2		24.8	333 21.8	12.0		14 57.5	10.1	56.3
02	209 42.0		24.8	347 52.8	12.0		14 47.4	10.1	56.3
03	224 41.9	. .	24.9	2 23.8	12.2		14 37.3	10.2	56.3
04	239 41.7		24.9	16 55.0	12.2		14 27.1	10.2	56.2
05	254 41.6		24.9	31 26.2	12.3		14 16.9	10.3	56.2
06	269 41.5		N23 25.0	45 57.5	12.4		S14 06.6	10.3	56.2
07	284 41.3		25.0	60 28.9	12.4		13 56.3	10.4	56.1
08	299 41.2		25.1	75 00.3	12.6		13 45.9	10.4	56.1
S 09	314 41.1	. .	25.1	89 31.9	12.6		13 35.5	10.5	56.1
U 10	329 40.9		25.1	104 03.5	12.7		13 25.0	10.6	56.1
N 11	344 40.8		25.2	118 35.2	12.7		13 14.4	10.6	56.0
D 12	359 40.7		N23 25.2	133 06.9	12.9		S13 03.8	10.6	56.0
A 13	14 40.5		25.3	147 38.8	12.9		12 53.2	10.7	56.0
Y 14	29 40.4		25.3	162 10.7	13.0		12 42.5	10.7	55.9
15	44 40.3	. .	25.3	176 42.7	13.1		12 31.8	10.8	55.9
16	59 40.1		25.4	191 14.8	13.2		12 21.0	10.8	55.9
17	74 40.0		25.4	205 47.0	13.2		12 10.2	10.9	55.9
18	89 39.9		N23 25.4	220 19.2	13.3		S11 59.3	10.9	55.8
19	104 39.7		25.5	234 51.5	13.4		11 48.4	11.0	55.8
20	119 39.6		25.5	249 23.9	13.4		11 37.4	11.0	55.8
21	134 39.4	. .	25.5	263 56.3	13.5		11 26.4	11.0	55.7
22	149 39.3		25.6	278 28.8	13.6		11 15.4	11.1	55.7
23	164 39.2		25.6	293 01.4	13.7		11 04.3	11.1	55.7
20 00	179 39.0		N23 25.6	307 34.1	13.7		S10 53.2	11.1	55.7
01	194 38.9		25.7	322 06.8	13.8		10 42.1	11.2	55.6
02	209 38.8		25.7	336 39.6	13.8		10 30.9	11.2	55.6
03	224 38.6	. .	25.7	351 12.4	13.9		10 19.7	11.3	55.6
04	239 38.5		25.7	5 45.3	14.0		10 08.4	11.3	55.6
05	254 38.4		25.8	20 18.3	14.1		9 57.1	11.3	55.5
06	269 38.2		N23 25.8	34 51.4	14.1		S 9 45.8	11.3	55.5
07	284 38.1		25.8	49 24.5	14.1		9 34.5	11.4	55.5
08	299 38.0		25.8	63 57.6	14.3		9 23.1	11.4	55.5
M 09	314 37.8	. .	25.9	78 30.9	14.2		9 11.7	11.4	55.4
O 10	329 37.7		25.9	93 04.1	14.4		9 00.3	11.5	55.4
N 11	344 37.5		25.9	107 37.5	14.4		8 48.8	11.5	55.4
D 12	359 37.4		N23 25.9	122 10.9	14.5		S 8 37.3	11.5	55.4
A 13	14 37.3		26.0	136 44.4	14.5		8 25.8	11.5	55.3
Y 14	29 37.1		26.0	151 17.9	14.5		8 14.3	11.6	55.3
15	44 37.0	. .	26.0	165 51.4	14.7		8 02.7	11.6	55.3
16	59 36.9		26.0	180 25.1	14.6		7 51.1	11.6	55.3
17	74 36.7		26.0	194 58.7	14.8		7 39.5	11.6	55.2
18	89 36.6		N23 26.1	209 32.5	14.8		S 7 27.9	11.6	55.2
19	104 36.5		26.1	224 06.3	14.8		7 16.3	11.7	55.2
20	119 36.3		26.1	238 40.1	14.9		7 04.6	11.7	55.2
21	134 36.2	. .	26.1	253 14.0	14.9		6 52.9	11.7	55.2
22	149 36.1		26.1	267 47.9	15.0		6 41.2	11.7	55.1
23	164 35.9		26.1	282 21.9	15.0		S 6 29.5	11.7	55.1
	SD 15.8		d 0.0	SD	15.4			15.3	15.1

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		18	19	20	21
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	▬	(00 33 / 23 57)	23 33	23 14
N 70	▭	▭	▭	(00 35 / 23 59)	23 39	23 24	23 12
68	▭	▭	▭	23 34	23 25	23 17	23 10
66	▭	▭	▭	23 16	23 13	23 11	23 08
64	////	////	01 31	23 00	23 04	23 05	23 07
62	////	////	02 09	22 48	22 55	23 01	23 05
60	////	00 50	02 36	22 37	22 48	22 57	23 04
N 58	////	01 40	02 56	22 27	22 42	22 53	23 03
56	////	02 10	03 13	22 19	22 36	22 50	23 02
54	00 45	02 33	03 27	22 11	22 31	22 47	23 02
52	01 32	02 51	03 39	22 05	22 26	22 45	23 01
50	02 00	03 06	03 50	21 58	22 22	22 42	23 00
45	02 46	03 35	04 13	21 45	22 13	22 37	22 59
N 40	03 16	03 58	04 31	21 34	22 05	22 33	22 58
35	03 39	04 16	04 46	21 25	21 59	22 29	22 57
30	03 58	04 31	04 59	21 17	21 53	22 25	22 56
20	04 27	04 56	05 21	21 03	21 43	22 20	22 54
N 10	04 50	05 17	05 40	20 50	21 34	22 14	22 53
0	05 09	05 35	05 58	20 39	21 25	22 09	22 52
S 10	05 26	05 52	06 15	20 27	21 17	22 05	22 50
20	05 42	06 10	06 34	20 14	21 08	21 59	22 49
30	05 59	06 28	06 55	20 00	20 58	21 54	22 47
35	06 07	06 39	07 07	19 51	20 52	21 50	22 46
40	06 17	06 51	07 21	19 42	20 45	21 46	22 45
45	06 27	07 04	07 38	19 31	20 37	21 42	22 44
S 50	06 39	07 20	07 59	19 17	20 28	21 36	22 43
52	06 44	07 28	08 09	19 10	20 23	21 34	22 42
54	06 50	07 36	08 20	19 03	20 18	21 31	22 42
56	06 56	07 45	08 33	18 55	20 13	21 28	22 41
58	07 03	07 56	08 47	18 46	20 07	21 25	22 40
S 60	07 10	08 07	09 05	18 36	20 00	21 21	22 39

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	18	19	20	21
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	▬	05 28	07 39	09 32
N 70	▭	▭	▭	03 40	06 00	07 54	09 39
68	▭	▭	▭	04 26	06 22	08 07	09 44
66	▭	▭	▭	04 56	06 40	08 17	09 49
64	22 32	////	////	05 18	06 54	08 25	09 52
62	21 54	////	////	05 36	07 06	08 33	09 56
60	21 27	23 14	////	05 51	07 16	08 39	09 58
N 58	21 07	22 23	////	06 03	07 25	08 44	10 01
56	20 50	21 53	////	06 14	07 32	08 49	10 03
54	20 36	21 30	23 18	06 23	07 39	08 53	10 05
52	20 23	21 12	22 31	06 31	07 45	08 57	10 07
50	20 12	20 57	22 03	06 39	07 51	09 01	10 08
45	19 50	20 27	21 17	06 55	08 03	09 08	10 12
N 40	19 32	20 05	20 46	07 08	08 12	09 15	10 15
35	19 17	19 46	20 23	07 19	08 21	09 20	10 17
30	19 04	19 31	20 04	07 29	08 28	09 25	10 20
20	18 42	19 06	19 35	07 45	08 40	09 33	10 23
N 10	18 23	18 46	19 13	07 59	08 51	09 40	10 27
0	18 05	18 28	18 54	08 13	09 01	09 47	10 30
S 10	17 48	18 10	18 37	08 26	09 12	09 54	10 33
20	17 29	17 53	18 20	08 40	09 22	10 01	10 36
30	17 08	17 34	18 04	08 56	09 34	10 08	10 40
35	16 55	17 24	17 55	09 05	09 41	10 13	10 42
40	16 41	17 12	17 46	09 16	09 49	10 18	10 44
45	16 24	16 58	17 35	09 28	09 58	10 24	10 47
S 50	16 04	16 42	17 24	09 43	10 09	10 31	10 50
52	15 54	16 35	17 18	09 50	10 14	10 34	10 52
54	15 43	16 26	17 13	09 58	10 20	10 38	10 53
56	15 30	16 17	17 06	10 06	10 26	10 42	10 55
58	15 15	16 07	17 00	10 16	10 33	10 46	10 57
S 60	14 58	15 55	16 52	10 27	10 41	10 51	10 59

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
18	00 58	01 04	12 01	02 00	14 26	17	92
19	01 11	01 17	12 01	02 50	15 14	18	85
20	01 24	01 30	12 02	03 36	15 58	19	77

UT	ARIES	VENUS −3.8		MARS +1.4		JUPITER −2.2		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
21 00	268 50.9	196 14.2	N21 50.7	211 04.3	N19 55.9	237 28.5	N11 29.4	78 12.6	S 1 49.5
01	283 53.4	211 13.4	51.2	226 04.9	56.3	252 30.5	29.5	93 15.0	49.5
02	298 55.9	226 12.6	51.6	241 05.5	56.7	267 32.6	29.7	108 17.4	49.5
03	313 58.3	241 11.8 . .	52.1	256 06.1 . .	57.1	282 34.6 . .	29.8	123 19.9 . .	49.6
04	329 00.8	256 11.0	52.5	271 06.7	57.5	297 36.6	30.0	138 22.3	49.6
05	344 03.3	271 10.3	53.0	286 07.4	57.9	312 38.7	30.1	153 24.7	49.6
06	359 05.7	286 09.5	N21 53.5	301 08.0	N19 58.3	327 40.7	N11 30.3	168 27.2	S 1 49.6
07	14 08.2	301 08.7	53.9	316 08.6	58.7	342 42.7	30.4	183 29.6	49.6
T 08	29 10.7	316 07.9	54.4	331 09.2	59.1	357 44.7	30.6	198 32.1	49.7
U 09	44 13.1	331 07.1 . .	54.8	346 09.8 . .	59.5	12 46.8 . .	30.7	213 34.5 . .	49.7
E 10	59 15.6	346 06.3	55.3	1 10.4	19 59.9	27 48.8	30.9	228 36.9	49.7
S 11	74 18.0	1 05.5	55.7	16 11.0	20 00.3	42 50.8	31.0	243 39.4	49.7
D 12	89 20.5	16 04.7	N21 56.2	31 11.6	N20 00.7	57 52.8	N11 31.2	258 41.8	S 1 49.8
A 13	104 23.0	31 03.9	56.6	46 12.2	01.1	72 54.9	31.3	273 44.2	49.8
Y 14	119 25.4	46 03.1	57.0	61 12.8	01.5	87 56.9	31.4	288 46.7	49.8
15	134 27.9	61 02.4 . .	57.5	76 13.5 . .	01.9	102 58.9 . .	31.6	303 49.1 . .	49.8
16	149 30.4	76 01.6	57.9	91 14.1	02.3	118 00.9	31.7	318 51.5	49.9
17	164 32.8	91 00.8	58.4	106 14.7	02.7	133 03.0	31.9	333 54.0	49.9
18	179 35.3	106 00.0	N21 58.8	121 15.3	N20 03.1	148 05.0	N11 32.0	348 56.4	S 1 49.9
19	194 37.8	120 59.2	59.3	136 15.9	03.5	163 07.0	32.2	3 58.9	49.9
20	209 40.2	135 58.4	21 59.7	151 16.5	03.9	178 09.1	32.3	19 01.3	49.9
21	224 42.7	150 57.6	22 00.1	166 17.1 . .	04.4	193 11.1 . .	32.5	34 03.7 . .	50.0
22	239 45.2	165 56.8	00.6	181 17.7	04.8	208 13.1	32.6	49 06.2	50.0
23	254 47.6	180 56.0	01.0	196 18.3	05.2	223 15.1	32.8	64 08.6	50.0
22 00	269 50.1	195 55.2	N22 01.4	211 18.9	N20 05.5	238 17.2	N11 32.9	79 11.0	S 1 50.0
01	284 52.5	210 54.4	01.9	226 19.6	05.9	253 19.2	33.1	94 13.5	50.1
02	299 55.0	225 53.6	02.3	241 20.2	06.3	268 21.2	33.2	109 15.9	50.1
03	314 57.5	240 52.8 . .	02.7	256 20.8 . .	06.7	283 23.3 . .	33.4	124 18.3 . .	50.1
04	329 59.9	255 52.0	03.2	271 21.4	07.1	298 25.3	33.5	139 20.8	50.1
05	345 02.4	270 51.2	03.6	286 22.0	07.5	313 27.3	33.7	154 23.2	50.2
06	0 04.9	285 50.4	N22 04.0	301 22.6	N20 07.9	328 29.4	N11 33.8	169 25.6	S 1 50.2
W 07	15 07.3	300 49.6	04.4	316 23.2	08.3	343 31.4	34.0	184 28.1	50.2
E 08	30 09.8	315 48.8	04.9	331 23.8	08.7	358 33.4	34.1	199 30.5	50.2
D 09	45 12.3	330 48.0 . .	05.3	346 24.4 . .	09.1	13 35.4 . .	34.2	214 32.9 . .	50.3
N 10	60 14.7	345 47.2	05.7	1 25.0	09.5	28 37.5	34.4	229 35.4	50.3
E 11	75 17.2	0 46.4	06.1	16 25.6	09.9	43 39.5	34.5	244 37.8	50.3
S 12	90 19.6	15 45.6	N22 06.6	31 26.3	N20 10.3	58 41.5	N11 34.7	259 40.2	S 1 50.3
D 13	105 22.1	30 44.8	07.0	46 26.9	10.7	73 43.6	34.8	274 42.7	50.4
A 14	120 24.6	45 44.0	07.4	61 27.5	11.1	88 45.6	35.0	289 45.1	50.4
Y 15	135 27.0	60 43.2 . .	07.8	76 28.1 . .	11.5	103 47.6 . .	35.1	304 47.5 . .	50.4
16	150 29.5	75 42.4	08.2	91 28.7	11.9	118 49.7	35.3	319 50.0	50.4
17	165 32.0	90 41.6	08.7	106 29.3	12.3	133 51.7	35.4	334 52.4	50.5
18	180 34.4	105 40.8	N22 09.1	121 29.9	N20 12.7	148 53.7	N11 35.6	349 54.8	S 1 50.5
19	195 36.9	120 40.0	09.5	136 30.5	13.1	163 55.8	35.7	4 57.2	50.5
20	210 39.4	135 39.2	09.9	151 31.1	13.5	178 57.8	35.9	19 59.7	50.5
21	225 41.8	150 38.4 . .	10.3	166 31.7 . .	13.9	193 59.8 . .	36.0	35 02.1 . .	50.6
22	240 44.3	165 37.6	10.7	181 32.3	14.2	209 01.9	36.2	50 04.5	50.6
23	255 46.8	180 36.8	11.1	196 32.9	14.6	224 03.9	36.3	65 07.0	50.6
23 00	270 49.2	195 36.0	N22 11.5	211 33.6	N20 15.0	239 05.9	N11 36.4	80 09.4	S 1 50.6
01	285 51.7	210 35.2	12.0	226 34.2	15.4	254 08.0	36.6	95 11.8	50.7
02	300 54.1	225 34.4	12.4	241 34.8	15.8	269 10.0	36.7	110 14.3	50.7
03	315 56.6	240 33.6 . .	12.8	256 35.4 . .	16.2	284 12.0 . .	36.9	125 16.7 . .	50.7
04	330 59.1	255 32.8	13.2	271 36.0	16.6	299 14.1	37.0	140 19.1	50.7
05	346 01.5	270 32.0	13.6	286 36.6	17.0	314 16.1	37.2	155 21.6	50.8
06	1 04.0	285 31.2	N22 14.0	301 37.2	N20 17.4	329 18.1	N11 37.3	170 24.0	S 1 50.8
07	16 06.5	300 30.4	14.4	316 37.8	17.8	344 20.2	37.5	185 26.4	50.8
T 08	31 08.9	315 29.6	14.8	331 38.4	18.1	359 22.2	37.6	200 28.8	50.8
H 09	46 11.4	330 28.8 . .	15.2	346 39.0 . .	18.5	14 24.2 . .	37.8	215 31.3 . .	50.9
U 10	61 13.9	345 28.0	15.6	1 39.6	18.9	29 26.3	37.9	230 33.7	50.9
R 11	76 16.3	0 27.2	16.0	16 40.2	19.3	44 28.3	38.0	245 36.1	50.9
S 12	91 18.8	15 26.3	N22 16.4	31 40.9	N20 19.7	59 30.3	N11 38.2	260 38.6	S 1 50.9
D 13	106 21.3	30 25.5	16.8	46 41.5	20.1	74 32.4	38.3	275 41.0	51.0
A 14	121 23.7	45 24.7	17.2	61 42.1	20.5	89 34.4	38.5	290 43.4	51.0
Y 15	136 26.2	60 23.9 . .	17.5	76 42.7 . .	20.9	104 36.4 . .	38.6	305 45.8 . .	51.0
16	151 28.6	75 23.1	17.9	91 43.3	21.2	119 38.5	38.8	320 48.3	51.1
17	166 31.1	90 22.3	18.3	106 43.9	21.6	134 40.5	38.9	335 50.7	51.1
18	181 33.6	105 21.5	N22 18.7	121 44.5	N20 22.0	149 42.5	N11 39.1	350 53.1	S 1 51.1
19	196 36.0	120 20.7	19.1	136 45.1	22.4	164 44.6	39.2	5 55.6	51.1
20	211 38.5	135 19.9	19.5	151 45.7	22.8	179 46.6	39.3	20 58.0	51.2
21	226 41.0	150 19.1 . .	19.9	166 46.3 . .	23.2	194 48.6 . .	39.5	36 00.4 . .	51.2
22	241 43.4	165 18.2	20.3	181 46.9	23.5	209 50.7	39.6	51 02.8	51.2
23	256 45.9	180 17.4	20.6	196 47.5	23.9	224 52.7	39.8	66 05.3	51.2
	h m								
Mer. Pass.	5 59.7	v −0.8	d 0.4	v 0.6	d 0.4	v 2.0	d 0.1	v 2.4	d 0.0

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.7	S40 15.3
Achernar	335 28.0	S57 10.4
Acrux	173 10.9	S63 10.2
Adhara	255 14.0	S28 59.4
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.7	N55 54.0
Alkaid	152 59.7	N49 15.5
Al Na'ir	27 45.2	S46 54.0
Alnilam	275 48.1	S 1 11.7
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.6
Alpheratz	357 45.0	N29 09.2
Altair	62 09.3	N 8 54.0
Ankaa	353 17.1	S42 14.3
Antares	112 27.6	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.2	S69 02.9
Avior	234 19.2	S59 33.1
Bellatrix	278 33.9	N 6 21.5
Betelgeuse	271 03.2	N 7 24.5
Canopus	263 57.3	S52 42.2
Capella	280 37.0	N46 00.5
Deneb	49 32.1	N45 19.2
Denebola	182 35.1	N14 30.4
Diphda	348 57.3	S17 55.2
Dubhe	193 53.5	N61 41.5
Elnath	278 14.8	N28 36.9
Eltanin	90 46.2	N51 29.3
Enif	33 48.3	N 9 55.7
Fomalhaut	15 25.4	S29 33.4
Gacrux	172 02.5	S57 11.0
Gienah	175 53.7	S17 36.5
Hadar	148 49.6	S60 26.0
Hamal	328 02.6	N23 30.9
Kaus Aust.	83 45.3	S34 22.6
Kochab	137 19.0	N74 06.7
Markab	13 39.7	N15 16.1
Menkar	314 16.8	N 4 08.1
Menkent	148 09.0	S36 25.8
Miaplacidus	221 40.7	S69 46.2
Mirfak	308 42.8	N49 54.0
Nunki	75 59.7	S26 16.8
Peacock	53 20.9	S56 41.6
Pollux	243 29.8	N27 59.9
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.4	N12 33.2
Regulus	207 45.2	N11 54.6
Rigel	281 13.7	S 8 11.3
Rigil Kent.	139 53.3	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.3	N56 35.8
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.8	S43 29.0
Vega	80 39.5	N38 47.7
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	286 05.1	10 57
Mars	301 28.9	9 54
Jupiter	328 27.1	8 06
Saturn	169 20.9	18 40

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
21 00	179 35.8	N23 26.1	296 55.9	15.1	S 6 17.8	11.8	55.1
01	194 35.6	26.2	311 30.0	15.1	6 06.0	11.8	55.1
02	209 35.5	26.2	326 04.1	15.1	5 54.2	11.7	55.0
03	224 35.4	26.2	340 38.2	15.2	5 42.5	11.8	55.0
04	239 35.2	26.2	355 12.4	15.3	5 30.7	11.8	55.0
05	254 35.1	26.2	9 46.7	15.3	5 18.9	11.9	55.0
06	269 35.0	N23 26.2	24 21.0	15.3	S 5 07.0	11.8	55.0
07	284 34.8	26.2	38 55.3	15.4	4 55.2	11.8	54.9
08	299 34.7	26.2	53 29.7	15.4	4 43.4	11.9	54.9
09	314 34.6	26.2	68 04.1	15.4	4 31.5	11.8	54.9
10	329 34.4	26.2	82 38.5	15.5	4 19.7	11.9	54.9
11	344 34.3	26.2	97 13.0	15.5	4 07.8	11.9	54.9
12	359 34.2	N23 26.2	111 47.5	15.5	S 3 55.9	11.9	54.8
13	14 34.0	26.2	126 22.0	15.6	3 44.0	11.8	54.8
14	29 33.9	26.2	140 56.6	15.6	3 32.2	11.9	54.8
15	44 33.7	26.2	155 31.2	15.6	3 20.3	11.9	54.8
16	59 33.6	26.2	170 05.8	15.7	3 08.4	11.9	54.8
17	74 33.5	26.2	184 40.5	15.7	2 56.5	11.9	54.8
18	89 33.3	N23 26.2	199 15.2	15.7	S 2 44.6	11.9	54.7
19	104 33.2	26.2	213 49.9	15.7	2 32.7	12.0	54.7
20	119 33.1	26.2	228 24.6	15.8	2 20.7	11.9	54.7
21	134 32.9	26.2	242 59.4	15.8	2 08.8	11.9	54.7
22	149 32.8	26.2	257 34.2	15.8	1 56.9	11.9	54.7
23	164 32.7	26.2	272 09.0	15.9	1 45.0	11.9	54.7
22 00	179 32.5	N23 26.2	286 43.9	15.9	S 1 33.1	11.9	54.6
01	194 32.4	26.2	301 18.8	15.8	1 21.2	11.9	54.6
02	209 32.3	26.2	315 53.6	16.0	1 09.3	11.9	54.6
03	224 32.1	26.2	330 28.6	15.9	0 57.4	11.9	54.6
04	239 32.0	26.2	345 03.5	15.9	0 45.5	11.9	54.6
05	254 31.9	26.2	359 38.4	16.0	0 33.6	11.9	54.6
06	269 31.7	N23 26.2	14 13.4	16.0	S 0 21.7	11.9	54.6
07	284 31.6	26.2	28 48.4	16.0	S 0 09.8	11.9	54.5
08	299 31.4	26.2	43 23.4	16.0	N 0 02.1	11.9	54.5
09	314 31.3	26.2	57 58.4	16.0	0 14.0	11.8	54.5
10	329 31.2	26.1	72 33.4	16.0	0 25.8	11.9	54.5
11	344 31.0	26.1	87 08.4	16.1	0 37.7	11.8	54.5
12	359 30.9	N23 26.1	101 43.5	16.0	N 0 49.5	11.9	54.5
13	14 30.8	26.1	116 18.5	16.1	1 01.4	11.8	54.5
14	29 30.6	26.1	130 53.6	16.1	1 13.2	11.8	54.5
15	44 30.5	26.1	145 28.7	16.0	1 25.0	11.9	54.4
16	59 30.4	26.1	160 03.7	16.1	1 36.9	11.8	54.4
17	74 30.2	26.0	174 38.8	16.1	1 48.7	11.8	54.4
18	89 30.1	N23 26.0	189 13.9	16.1	N 2 00.5	11.7	54.4
19	104 30.0	26.0	203 49.0	16.1	2 12.2	11.8	54.4
20	119 29.8	26.0	218 24.1	16.1	2 24.0	11.8	54.4
21	134 29.7	26.0	232 59.2	16.1	2 35.8	11.7	54.4
22	149 29.6	26.0	247 34.3	16.1	2 47.5	11.7	54.4
23	164 29.4	25.9	262 09.4	16.1	2 59.2	11.7	54.4
23 00	179 29.3	N23 25.9	276 44.5	16.1	N 3 10.9	11.7	54.4
01	194 29.1	25.9	291 19.6	16.1	3 22.6	11.7	54.4
02	209 29.0	25.9	305 54.7	16.1	3 34.3	11.7	54.3
03	224 28.9	25.8	320 29.8	16.1	3 46.0	11.6	54.3
04	239 28.7	25.8	335 04.9	16.1	3 57.6	11.6	54.3
05	254 28.6	25.8	349 40.0	16.1	4 09.2	11.6	54.3
06	269 28.5	N23 25.8	4 15.1	16.0	N 4 20.8	11.6	54.3
07	284 28.3	25.7	18 50.1	16.1	4 32.4	11.6	54.3
08	299 28.2	25.7	33 25.2	16.1	4 44.0	11.5	54.3
09	314 28.1	25.7	48 00.3	16.0	4 55.5	11.6	54.3
10	329 27.9	25.7	62 35.3	16.0	5 07.1	11.5	54.3
11	344 27.8	25.6	77 10.3	16.1	5 18.6	11.4	54.3
12	359 27.7	N23 25.6	91 45.4	16.0	N 5 30.0	11.5	54.3
13	14 27.5	25.6	106 20.4	16.0	5 41.5	11.4	54.3
14	29 27.4	25.5	120 55.4	15.9	5 52.9	11.4	54.3
15	44 27.3	25.5	135 30.3	16.0	6 04.3	11.4	54.3
16	59 27.1	25.5	150 05.3	16.0	6 15.7	11.4	54.3
17	74 27.0	25.4	164 40.3	15.9	6 27.1	11.3	54.3
18	89 26.9	N23 25.4	179 15.2	15.9	N 6 38.4	11.3	54.3
19	104 26.7	25.4	193 50.1	15.9	6 49.7	11.3	54.3
20	119 26.6	25.3	208 25.0	15.9	7 01.0	11.2	54.2
21	134 26.4	25.3	222 59.9	15.8	7 12.2	11.3	54.2
22	149 26.3	25.2	237 34.7	15.9	7 23.5	11.2	54.2
23	164 26.2	25.2	252 09.6	15.8	N 7 34.7	11.1	54.2
	SD 15.8	d 0.0	SD	14.9		14.8	14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 21	Moonrise 22	Moonrise 23	Moonrise 24
	h m	h m	h m	h m	h m	h m	h m
N 72				23 14	22 56	22 36	22 13
N 70				23 12	23 00	22 47	22 33
68				23 10	23 03	22 56	22 48
66				23 08	23 05	23 03	23 00
64	////	////	01 31	23 07	23 08	23 09	23 11
62	////	////	02 09	23 05	23 10	23 14	23 20
60	////	00 49	02 36	23 04	23 11	23 19	23 28
N 58	////	01 41	02 56	23 03	23 13	23 23	23 35
56	////	02 11	03 13	23 02	23 14	23 27	23 41
54	00 45	02 33	03 28	23 02	23 16	23 30	23 46
52	01 32	02 51	03 40	23 01	23 17	23 33	23 51
50	02 00	03 06	03 51	23 00	23 18	23 36	23 56
45	02 46	03 36	04 13	22 59	23 20	23 42	24 05
N 40	03 17	03 59	04 31	22 58	23 22	23 47	24 13
35	03 40	04 17	04 47	22 57	23 24	23 51	24 20
30	03 59	04 32	05 00	22 56	23 25	23 55	24 27
20	04 28	04 57	05 22	22 54	23 28	24 02	00 02
N 10	04 50	05 18	05 41	22 53	23 30	24 08	00 08
0	05 09	05 36	05 58	22 52	23 33	24 14	00 14
S 10	05 27	05 53	06 16	22 50	23 35	24 20	00 20
20	05 43	06 10	06 34	22 49	23 37	24 26	00 26
30	05 59	06 29	06 56	22 47	23 40	24 33	00 33
35	06 08	06 40	07 08	22 46	23 42	24 37	00 37
40	06 17	06 52	07 22	22 45	23 44	24 41	00 41
45	06 28	07 05	07 39	22 44	23 46	24 47	00 47
S 50	06 40	07 21	08 00	22 43	23 48	24 53	00 53
52	06 45	07 29	08 10	22 42	23 49	24 56	00 56
54	06 51	07 37	08 21	22 42	23 51	25 00	01 00
56	06 57	07 46	08 34	22 41	23 52	25 03	01 03
58	07 04	07 56	08 48	22 40	23 54	25 07	01 07
S 60	07 11	08 08	09 06	22 39	23 56	25 12	01 12

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 21	Moonset 22	Moonset 23	Moonset 24
	h m	h m	h m	h m	h m	h m	h m
N 72				09 32	11 19	13 05	14 56
N 70				09 39	11 18	12 57	14 38
68				09 44	11 18	12 50	14 24
66				09 49	11 17	12 45	14 13
64	22 33	////	////	09 52	11 17	12 40	14 04
62	21 54	////	////	09 56	11 16	12 36	13 56
60	21 28	23 14	////	09 58	11 16	12 32	13 49
N 58	21 07	22 23	////	10 01	11 16	12 29	13 43
56	20 51	21 53	////	10 03	11 15	12 26	13 38
54	20 36	21 31	23 19	10 05	11 15	12 24	13 33
52	20 24	21 13	22 31	10 07	11 15	12 22	13 29
50	20 13	20 58	22 03	10 08	11 14	12 20	13 25
45	19 50	20 28	21 18	10 12	11 14	12 15	13 16
N 40	19 32	20 05	20 47	10 15	11 14	12 11	13 09
35	19 17	19 47	20 24	10 17	11 13	12 08	13 03
30	19 04	19 32	20 05	10 20	11 13	12 05	12 58
20	18 42	19 07	19 36	10 23	11 12	12 01	12 49
N 10	18 23	18 46	19 13	10 27	11 12	11 56	12 41
0	18 06	18 28	18 54	10 30	11 11	11 52	12 34
S 10	17 48	18 11	18 37	10 33	11 11	11 48	12 27
20	17 30	17 54	18 21	10 36	11 10	11 44	12 19
30	17 08	17 35	18 05	10 40	11 10	11 39	12 10
35	16 56	17 24	17 56	10 42	11 09	11 37	12 05
40	16 42	17 12	17 46	10 44	11 09	11 34	11 59
45	16 25	16 59	17 36	10 47	11 09	11 30	11 52
S 50	16 04	16 43	17 24	10 50	11 08	11 26	11 44
52	15 54	16 35	17 19	10 52	11 08	11 24	11 41
54	15 43	16 27	17 13	10 53	11 07	11 21	11 37
56	15 30	16 18	17 07	10 55	11 07	11 19	11 32
58	15 16	16 08	17 00	10 57	11 07	11 17	11 27
S 60	14 58	15 56	16 53	10 59	11 06	11 14	11 22

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	%
21	01 37	01 43	12 02	04 20	16 41	20	69
22	01 50	01 56	12 02	05 01	17 22	21	60
23	02 03	02 09	12 02	05 43	18 03	22	50

TUESDAY

WEDNESDAY

THURSDAY

UT	ARIES	VENUS −3.8		MARS +1.4		JUPITER −2.2		SATURN +0.9		STARS		
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Name	SHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
24 00	271 48.4	195 16.6	N22 21.0	211 48.1	N20 24.3	239 54.8	N11 39.9	81 07.7	S 1 51.3	Acamar	315 19.7	S40 15.3
01	286 50.8	210 15.8	21.4	226 48.7	24.7	254 56.8	40.1	96 10.1	51.3	Achernar	335 28.0	S57 10.4
02	301 53.3	225 15.0	21.8	241 49.4	25.1	269 58.8	40.2	111 12.5	51.3	Acrux	173 10.9	S63 10.2
03	316 55.7	240 14.2	22.2	256 50.0	25.5	285 00.9	40.3	126 15.0	51.3	Adhara	255 14.0	S28 59.4
04	331 58.2	255 13.4	22.6	271 50.6	25.8	300 02.9	40.5	141 17.4	51.4	Aldebaran	290 51.3	N16 31.9
05	347 00.7	270 12.6	22.9	286 51.2	26.2	315 04.9	40.6	156 19.8	51.4			
06	2 03.1	285 11.7	N22 23.3	301 51.8	N20 26.6	330 07.0	N11 40.8	171 22.2	S 1 51.4	Alioth	166 21.7	N55 54.0
07	17 05.6	300 10.9	23.7	316 52.4	27.0	345 09.0	40.9	186 24.7	51.5	Alkaid	152 59.7	N49 15.5
08	32 08.1	315 10.1	24.1	331 53.0	27.4	0 11.1	41.1	201 27.1	51.5	Al Na'ir	27 45.2	S46 54.0
F 09	47 10.5	330 09.3	24.4	346 53.6	27.7	15 13.1	41.2	216 29.5	51.5	Alnilam	275 48.1	S 1 11.7
R 10	62 13.0	345 08.5	24.8	1 54.2	28.1	30 15.1	41.4	231 31.9	51.5	Alphard	217 57.7	S 8 42.7
I 11	77 15.5	0 07.7	25.2	16 54.8	28.5	45 17.2	41.5	246 34.4	51.6			
D 12	92 17.9	15 06.9	N22 25.5	31 55.4	N20 28.9	60 19.2	N11 41.6	261 36.8	S 1 51.6	Alphecca	126 11.9	N26 40.7
A 13	107 20.4	30 06.0	25.9	46 56.0	29.3	75 21.2	41.8	276 39.2	51.6	Alpheratz	357 45.0	N29 09.2
Y 14	122 22.9	45 05.2	26.3	61 56.6	29.6	90 23.3	41.9	291 41.6	51.7	Altair	62 09.3	N 8 54.0
15	137 25.3	60 04.4	26.6	76 57.2	30.0	105 25.3	42.1	306 44.1	51.7	Ankaa	353 17.1	S42 14.3
16	152 27.8	75 03.6	27.0	91 57.8	30.4	120 27.4	42.2	321 46.5	51.7	Antares	112 27.6	S26 27.5
17	167 30.2	90 02.8	27.4	106 58.5	30.8	135 29.4	42.4	336 48.9	51.7			
18	182 32.7	105 02.0	N22 27.7	121 59.1	N20 31.1	150 31.4	N11 42.5	351 51.3	S 1 51.8	Arcturus	145 56.8	N19 07.4
19	197 35.2	120 01.1	28.1	136 59.7	31.5	165 33.5	42.6	6 53.8	51.8	Atria	107 30.2	S69 03.0
20	212 37.6	135 00.3	28.5	152 00.3	31.9	180 35.5	42.8	21 56.2	51.8	Avior	234 19.2	S59 33.0
21	227 40.1	149 59.5	28.8	167 00.9	32.3	195 37.6	42.9	36 58.6	51.9	Bellatrix	278 33.8	N 6 21.5
22	242 42.6	164 58.7	29.2	182 01.5	32.7	210 39.6	43.1	52 01.0	51.9	Betelgeuse	271 03.2	N 7 24.5
23	257 45.0	179 57.9	29.5	197 02.1	33.0	225 41.6	43.2	67 03.5	51.9			
25 00	272 47.5	194 57.0	N22 29.9	212 02.7	N20 33.4	240 43.7	N11 43.3	82 05.9	S 1 51.9	Canopus	263 57.3	S52 42.2
01	287 50.0	209 56.2	30.2	227 03.3	33.8	255 45.7	43.5	97 08.3	52.0	Capella	280 37.0	N46 00.5
02	302 52.4	224 55.4	30.6	242 03.9	34.1	270 47.8	43.6	112 10.7	52.0	Deneb	49 32.1	N45 19.3
03	317 54.9	239 54.6	30.9	257 04.5	34.5	285 49.8	43.8	127 13.2	52.0	Denebola	182 35.1	N14 30.4
04	332 57.4	254 53.8	31.3	272 05.1	34.9	300 51.8	43.9	142 15.6	52.1	Diphda	348 57.3	S17 55.2
05	347 59.8	269 52.9	31.7	287 05.7	35.3	315 53.9	44.1	157 18.0	52.1			
06	3 02.3	284 52.1	N22 32.0	302 06.3	N20 35.6	330 55.9	N11 44.2	172 20.4	S 1 52.1	Dubhe	193 53.5	N61 41.5
07	18 04.7	299 51.3	32.3	317 06.9	36.0	345 58.0	44.3	187 22.8	52.1	Elnath	278 14.8	N28 36.9
S 08	33 07.2	314 50.5	32.7	332 07.5	36.4	1 00.0	44.5	202 25.3	52.2	Eltanin	90 46.2	N51 29.3
A 09	48 09.7	329 49.7	33.0	347 08.2	36.8	16 02.1	44.6	217 27.7	52.2	Enif	33 48.3	N 9 55.8
T 10	63 12.1	344 48.8	33.4	2 08.8	37.1	31 04.1	44.8	232 30.1	52.2	Fomalhaut	15 25.4	S29 33.4
U 11	78 14.6	359 48.0	33.7	17 09.4	37.5	46 06.1	44.9	247 32.5	52.3			
R 12	93 17.1	14 47.2	N22 34.1	32 10.0	N20 37.9	61 08.2	N11 45.0	262 34.9	S 1 52.3	Gacrux	172 02.5	S57 11.0
D 13	108 19.5	29 46.4	34.4	47 10.6	38.2	76 10.2	45.2	277 37.4	52.3	Gienah	175 53.8	S17 36.5
A 14	123 22.0	44 45.5	34.8	62 11.2	38.6	91 12.3	45.3	292 39.8	52.3	Hadar	148 49.6	S60 26.0
Y 15	138 24.5	59 44.7	35.1	77 11.8	39.0	106 14.3	45.5	307 42.2	52.4	Hamal	328 02.5	N23 30.9
16	153 26.9	74 43.9	35.4	92 12.4	39.3	121 16.4	45.6	322 44.6	52.4	Kaus Aust.	83 45.3	S34 22.6
17	168 29.4	89 43.1	35.8	107 13.0	39.7	136 18.4	45.8	337 47.0	52.4			
18	183 31.8	104 42.2	N22 36.1	122 13.6	N20 40.1	151 20.4	N11 45.9	352 49.5	S 1 52.5	Kochab	137 19.1	N74 06.7
19	198 34.3	119 41.4	36.4	137 14.2	40.4	166 22.5	46.0	7 51.9	52.5	Markab	13 39.6	N15 16.1
20	213 36.8	134 40.6	36.8	152 14.8	40.8	181 24.5	46.2	22 54.3	52.5	Menkar	314 16.7	N 4 08.1
21	228 39.2	149 39.8	37.1	167 15.4	41.2	196 26.6	46.3	37 56.7	52.6	Menkent	148 09.1	S36 25.8
22	243 41.7	164 38.9	37.4	182 16.0	41.5	211 28.6	46.5	52 59.1	52.6	Miaplacidus	221 40.8	S69 46.2
23	258 44.2	179 38.1	37.8	197 16.6	41.9	226 30.7	46.6	68 01.6	52.6			
26 00	273 46.6	194 37.3	N22 38.1	212 17.2	N20 42.3	241 32.7	N11 46.7	83 04.0	S 1 52.6	Mirfak	308 42.8	N49 54.0
01	288 49.1	209 36.4	38.4	227 17.8	42.6	256 34.8	46.9	98 06.4	52.7	Nunki	75 59.7	S26 16.8
02	303 51.6	224 35.6	38.8	242 18.4	43.0	271 36.8	47.0	113 08.8	52.7	Peacock	53 20.9	S56 41.6
03	318 54.0	239 34.8	39.1	257 19.0	43.4	286 38.8	47.2	128 11.2	52.7	Pollux	243 29.8	N27 59.9
04	333 56.5	254 34.0	39.4	272 19.7	43.7	301 40.9	47.3	143 13.7	52.8	Procyon	245 01.5	N 5 11.6
05	348 59.0	269 33.1	39.7	287 20.3	44.1	316 42.9	47.4	158 16.1	52.8			
06	4 01.4	284 32.3	N22 40.1	302 20.9	N20 44.5	331 45.0	N11 47.6	173 18.5	S 1 52.8	Rasalhague	96 07.4	N12 33.2
07	19 03.9	299 31.5	40.4	317 21.5	44.8	346 47.0	47.7	188 20.9	52.9	Regulus	207 45.2	N11 54.6
08	34 06.3	314 30.6	40.7	332 22.1	45.2	1 49.1	47.9	203 23.3	52.9	Rigel	281 13.7	S 8 11.3
S 09	49 08.8	329 29.8	41.0	347 22.7	45.6	16 51.1	48.0	218 25.8	52.9	Rigil Kent.	139 53.3	S60 53.2
U 10	64 11.3	344 29.0	41.3	2 23.3	45.9	31 53.2	48.1	233 28.2	53.0	Sabik	102 13.8	S15 44.3
N 11	79 13.7	359 28.2	41.7	17 23.9	46.3	46 55.2	48.3	248 30.6	53.0			
D 12	94 16.2	14 27.3	N22 42.0	32 24.5	N20 46.6	61 57.3	N11 48.4	263 33.0	S 1 53.0	Schedar	349 42.3	N56 35.8
A 13	109 18.7	29 26.5	42.3	47 25.1	47.0	76 59.3	48.6	278 35.4	53.0	Shaula	96 23.4	S37 06.7
Y 14	124 21.1	44 25.7	42.6	62 25.7	47.4	92 01.4	48.7	293 37.8	53.1	Sirius	258 35.3	S16 44.0
15	139 23.6	59 24.8	42.9	77 26.3	47.7	107 03.4	48.8	308 40.3	53.1	Spica	158 32.6	S11 13.4
16	154 26.1	74 24.0	43.2	92 26.9	48.1	122 05.4	49.0	323 42.7	53.1	Suhail	222 53.8	S43 29.0
17	169 28.5	89 23.2	43.5	107 27.5	48.5	137 07.5	49.1	338 45.1	53.2			
18	184 31.0	104 22.3	N22 43.8	122 28.1	N20 48.8	152 09.5	N11 49.3	353 47.5	S 1 53.2	Vega	80 39.5	N38 47.7
19	199 33.5	119 21.5	44.2	137 28.7	49.2	167 11.6	49.4	8 49.9	53.2	Zuben'ubi	137 06.8	S16 05.5
20	214 35.9	134 20.7	44.5	152 29.3	49.5	182 13.6	49.5	23 52.3	53.3			
21	229 38.4	149 19.8	44.8	167 29.9	49.9	197 15.7	49.7	38 54.8	53.3		SHA	Mer. Pass.
22	244 40.8	164 19.0	45.1	182 30.5	50.2	212 17.7	49.8	53 57.2	53.3		° ′	h m
23	259 43.3	179 18.2	45.4	197 31.1	50.6	227 19.8	49.9	68 59.6	53.4	Venus	282 09.5	11 01
	h m									Mars	299 15.2	9 51
Mer. Pass.	5 47.9	v −0.8	d 0.3	v 0.6	d 0.4	v 2.0	d 0.1	v 2.4	d 0.0	Jupiter	327 56.2	7 56
										Saturn	169 18.4	18 29

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
24 00	179 26.0	N23 25.2	266 44.4	15.8	N 7 45.8	11.2	54.2
01	194 25.9	25.1	281 19.2	15.7	7 57.0	11.1	54.2
02	209 25.8	25.1	295 53.9	15.8	8 08.1	11.0	54.2
03	224 25.6	. . 25.1	310 28.7	15.7	8 19.1	11.1	54.2
04	239 25.5	25.0	325 03.4	15.7	8 30.2	11.0	54.2
05	254 25.4	25.0	339 38.1	15.6	8 41.2	11.0	54.2
06	269 25.2	N23 24.9	354 12.7	15.6	N 8 52.2	10.9	54.2
07	284 25.1	24.9	8 47.3	15.6	9 03.1	10.9	54.2
08	299 25.0	24.8	23 21.9	15.6	9 14.0	10.9	54.2
F 09	314 24.8	. . 24.8	37 56.5	15.5	9 24.9	10.8	54.2
R 10	329 24.7	24.7	52 31.0	15.5	9 35.7	10.8	54.2
I 11	344 24.6	24.7	67 05.5	15.5	9 46.5	10.8	54.2
D 12	359 24.4	N23 24.6	81 40.0	15.4	N 9 57.3	10.7	54.2
A 13	14 24.3	24.6	96 14.4	15.4	10 08.0	10.7	54.3
Y 14	29 24.2	24.6	110 48.8	15.4	10 18.7	10.6	54.3
15	44 24.0	. . 24.5	125 23.2	15.3	10 29.3	10.6	54.3
16	59 23.9	24.5	139 57.5	15.3	10 39.9	10.6	54.3
17	74 23.8	24.4	154 31.8	15.3	10 50.5	10.5	54.3
18	89 23.6	N23 24.3	169 06.1	15.2	N11 01.0	10.5	54.3
19	104 23.5	24.3	183 40.3	15.2	11 11.5	10.5	54.3
20	119 23.4	24.2	198 14.5	15.1	11 22.0	10.4	54.3
21	134 23.2	. . 24.2	212 48.6	15.1	11 32.4	10.3	54.3
22	149 23.1	24.1	227 22.7	15.0	11 42.7	10.3	54.3
23	164 23.0	24.1	241 56.7	15.0	11 53.0	10.3	54.3
25 00	179 22.8	N23 24.0	256 30.7	15.0	N12 03.3	10.2	54.3
01	194 22.7	24.0	271 04.7	14.9	12 13.5	10.2	54.3
02	209 22.6	23.9	285 38.6	14.9	12 23.7	10.1	54.3
03	224 22.4	. . 23.9	300 12.5	14.8	12 33.8	10.1	54.3
04	239 22.3	23.8	314 46.3	14.8	12 43.9	10.1	54.3
05	254 22.2	23.7	329 20.1	14.7	12 54.0	9.9	54.3
06	269 22.0	N23 23.7	343 53.8	14.7	N13 03.9	10.0	54.3
07	284 21.9	23.6	358 27.5	14.7	13 13.9	9.9	54.3
S 08	299 21.8	23.5	13 01.2	14.6	13 23.8	9.8	54.4
A 09	314 21.6	. . 23.5	27 34.8	14.5	13 33.6	9.8	54.4
T 10	329 21.5	23.4	42 08.3	14.5	13 43.4	9.7	54.4
U 11	344 21.4	23.4	56 41.8	14.4	13 53.1	9.7	54.4
R 12	359 21.2	N23 23.3	71 15.2	14.4	N14 02.8	9.6	54.4
D 13	14 21.1	23.2	85 48.6	14.3	14 12.4	9.6	54.4
A 14	29 21.0	23.2	100 21.9	14.3	14 22.0	9.5	54.4
Y 15	44 20.8	. . 23.1	114 55.2	14.2	14 31.5	9.4	54.4
16	59 20.7	23.0	129 28.4	14.2	14 40.9	9.4	54.4
17	74 20.6	23.0	144 01.6	14.1	14 50.3	9.4	54.4
18	89 20.4	N23 22.9	158 34.7	14.0	N14 59.7	9.3	54.4
19	104 20.3	22.8	173 07.7	14.0	15 09.0	9.2	54.5
20	119 20.2	22.8	187 40.7	14.0	15 18.2	9.2	54.5
21	134 20.0	. . 22.7	202 13.7	13.9	15 27.4	9.1	54.5
22	149 19.9	22.6	216 46.6	13.8	15 36.5	9.0	54.5
23	164 19.8	22.5	231 19.4	13.8	15 45.5	9.0	54.5
26 00	179 19.6	N23 22.5	245 52.2	13.7	N15 54.5	8.9	54.5
01	194 19.5	22.4	260 24.9	13.6	16 03.4	8.9	54.5
02	209 19.4	22.3	274 57.5	13.6	16 12.3	8.7	54.5
03	224 19.2	. . 22.2	289 30.1	13.5	16 21.0	8.8	54.6
04	239 19.1	22.2	304 02.6	13.5	16 29.8	8.6	54.6
05	254 19.0	22.1	318 35.1	13.4	16 38.4	8.6	54.6
06	269 18.8	N23 22.0	333 07.5	13.3	N16 47.0	8.5	54.6
07	284 18.7	21.9	347 39.8	13.3	16 55.5	8.5	54.6
08	299 18.6	21.8	2 12.1	13.2	17 04.0	8.4	54.6
S 09	314 18.4	. . 21.8	16 44.3	13.1	17 12.4	8.3	54.6
U 10	329 18.3	21.7	31 16.4	13.1	17 20.7	8.2	54.7
N 11	344 18.2	21.6	45 48.5	13.0	17 28.9	8.2	54.7
D 12	359 18.0	N23 21.5	60 20.5	13.0	N17 37.1	8.1	54.7
A 13	14 17.9	21.4	74 52.5	12.9	17 45.2	8.0	54.7
Y 14	29 17.8	21.4	89 24.4	12.8	17 53.2	8.0	54.7
15	44 17.6	. . 21.3	103 56.2	12.7	18 01.2	7.8	54.7
16	59 17.5	21.2	118 27.9	12.7	18 09.0	7.8	54.7
17	74 17.4	21.1	132 59.6	12.7	18 16.8	7.8	54.8
18	89 17.2	N23 21.0	147 31.3	12.5	N18 24.6	7.6	54.8
19	104 17.1	20.9	162 02.8	12.5	18 32.2	7.6	54.8
20	119 17.0	20.8	176 34.3	12.4	18 39.8	7.4	54.8
21	134 16.8	. . 20.8	191 05.7	12.4	18 47.2	7.5	54.8
22	149 16.7	20.7	205 37.1	12.2	18 54.7	7.3	54.8
23	164 16.6	20.6	220 08.3	12.2	N19 02.0	7.2	54.9
	SD 15.8	d 0.1	SD 14.8		14.8		14.9

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 24	Moonrise 25	Moonrise 26	Moonrise 27
°	h m	h m	h m	h m	h m	h m	h m
N 72				22 13	21 39		
N 70				22 33	22 14	21 41	
68				22 48	22 39	22 27	22 04
66				23 00	22 59	22 58	23 00
64	////	////	01 33	23 11	23 14	23 21	23 33
62	////	////	02 11	23 20	23 28	23 39	23 58
60	////	00 51	02 37	23 28	23 39	23 54	24 17
N 58	////	01 42	02 58	23 35	23 49	24 07	00 07
56	////	02 12	03 14	23 41	23 57	24 19	00 19
54	00 47	02 34	03 29	23 46	24 05	00 05	00 28
52	01 34	02 52	03 41	23 51	24 12	00 12	00 37
50	02 02	03 07	03 52	23 56	24 18	00 18	00 45
45	02 47	03 37	04 14	24 05	00 05	00 31	01 02
N 40	03 18	03 59	04 32	24 13	00 13	00 43	01 16
35	03 41	04 18	04 47	24 20	00 20	00 52	01 28
30	03 59	04 33	05 00	24 27	00 27	01 01	01 38
20	04 29	04 58	05 22	00 02	00 37	01 15	01 56
N 10	04 51	05 18	05 41	00 08	00 47	01 28	02 12
0	05 10	05 36	05 59	00 14	00 56	01 40	02 26
S 10	05 27	05 54	06 16	00 20	01 05	01 52	02 41
20	05 43	06 11	06 35	00 26	01 15	02 05	02 57
30	06 00	06 30	06 56	00 33	01 26	02 20	03 15
35	06 09	06 40	07 08	00 37	01 32	02 29	03 26
40	06 18	06 52	07 23	00 41	01 40	02 39	03 38
45	06 28	07 06	07 39	00 47	01 48	02 50	03 53
S 50	06 40	07 22	08 00	00 53	01 59	03 05	04 11
52	06 45	07 29	08 10	00 56	02 04	03 11	04 19
54	06 51	07 37	08 21	01 00	02 09	03 19	04 29
56	06 57	07 46	08 34	01 03	02 15	03 27	04 40
58	07 04	07 57	08 48	01 07	02 22	03 37	04 52
S 60	07 11	08 08	09 06	01 12	02 29	03 48	05 06

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 24	Moonset 25	Moonset 26	Moonset 27
°	h m	h m	h m	h m	h m	h m	h m
N 72				14 56	17 00		
N 70				14 38	16 27	18 35	
68				14 24	16 03	17 49	19 53
66				14 13	15 44	17 19	18 58
64	22 32	////	////	14 04	15 29	16 57	18 25
62	21 54	////	////	13 56	15 17	16 39	18 01
60	21 28	23 13	////	13 49	15 06	16 25	17 42
N 58	21 07	22 23	////	13 43	14 57	16 12	17 26
56	20 51	21 53	////	13 38	14 49	16 02	17 13
54	20 36	21 31	23 17	13 33	14 42	15 52	17 01
52	20 24	21 13	22 31	13 29	14 36	15 44	16 51
50	20 13	20 58	22 03	13 25	14 30	15 36	16 42
45	19 51	20 28	21 18	13 16	14 18	15 20	16 23
N 40	19 33	20 06	20 47	13 09	14 08	15 07	16 07
35	19 18	19 48	20 24	13 03	13 59	14 56	15 54
30	19 05	19 32	20 06	12 58	13 52	14 47	15 42
20	18 43	19 07	19 37	12 49	13 39	14 30	15 23
N 10	18 24	18 47	19 14	12 41	13 27	14 16	15 06
0	18 06	18 29	18 55	12 34	13 17	14 02	14 50
S 10	17 49	18 12	18 38	12 27	13 06	13 49	14 34
20	17 30	17 54	18 22	12 19	12 55	13 34	14 17
30	17 09	17 35	18 05	12 10	12 42	13 18	13 58
35	16 57	17 25	17 57	12 05	12 35	13 08	13 46
40	16 43	17 13	17 47	11 59	12 27	12 58	13 34
45	16 26	17 00	17 37	11 52	12 17	12 45	13 18
S 50	16 05	16 44	17 25	11 44	12 05	12 30	13 00
52	15 55	16 36	17 20	11 41	12 00	12 22	12 51
54	15 44	16 28	17 14	11 37	11 54	12 14	12 41
56	15 31	16 19	17 08	11 32	11 47	12 06	12 30
58	15 17	16 09	17 01	11 27	11 40	11 56	12 17
S 60	14 59	15 57	16 54	11 22	11 31	11 44	12 02

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
24	02 16	02 22	12 02	06 24	18 45	23	41
25	02 28	02 35	12 03	07 06	19 28	24	31
26	02 41	02 48	12 03	07 51	20 14	25	23

UT	ARIES	VENUS −3.8		MARS +1.4		JUPITER −2.2		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
27 00	274 45.8	194 17.3	N22 45.7	212 31.7	N20 51.0	242 21.8	N11 50.1	84 02.0	S 1 53.4
01	289 48.2	209 16.5	46.0	227 32.3	51.3	257 23.9	50.2	99 04.4	53.4
02	304 50.7	224 15.7	46.3	242 32.9	51.7	272 25.9	50.4	114 06.8	53.5
03	319 53.2	239 14.8	46.6	257 33.6	52.0	287 28.0	50.5	129 09.2	53.5
04	334 55.6	254 14.0	46.9	272 34.2	52.4	302 30.0	50.6	144 11.7	53.5
05	349 58.1	269 13.2	47.2	287 34.8	52.7	317 32.1	50.8	159 14.1	53.6
06	5 00.6	284 12.3	N22 47.5	302 35.4	N20 53.1	332 34.1	N11 50.9	174 16.5	S 1 53.6
07	20 03.0	299 11.5	47.8	317 36.0	53.5	347 36.2	51.0	189 18.9	53.6
08	35 05.5	314 10.7	48.1	332 36.6	53.8	2 38.2	51.2	204 21.3	53.7
M 09	50 07.9	329 09.8	48.4	347 37.2	54.2	17 40.3	51.3	219 23.7	53.7
O 10	65 10.4	344 09.0	48.6	2 37.8	54.5	32 42.3	51.5	234 26.1	53.7
N 11	80 12.9	359 08.1	48.9	17 38.4	54.9	47 44.4	51.6	249 28.6	53.8
D 12	95 15.3	14 07.3	N22 49.2	32 39.0	N20 55.2	62 46.4	N11 51.7	264 31.0	S 1 53.8
A 13	110 17.8	29 06.5	49.5	47 39.6	55.6	77 48.5	51.9	279 33.4	53.8
Y 14	125 20.3	44 05.6	49.8	62 40.2	55.9	92 50.5	52.0	294 35.8	53.8
15	140 22.7	59 04.8	50.1	77 40.8	56.3	107 52.6	52.1	309 38.2	53.9
16	155 25.2	74 04.0	50.4	92 41.4	56.6	122 54.6	52.3	324 40.6	53.9
17	170 27.7	89 03.1	50.6	107 42.0	57.0	137 56.7	52.4	339 43.0	53.9
18	185 30.1	104 02.3	N22 50.9	122 42.6	N20 57.3	152 58.7	N11 52.6	354 45.4	S 1 54.0
19	200 32.6	119 01.4	51.2	137 43.2	57.7	168 00.8	52.7	9 47.9	54.0
20	215 35.1	134 00.6	51.5	152 43.8	58.0	183 02.8	52.8	24 50.3	54.0
21	230 37.5	148 59.8	51.8	167 44.4	58.4	198 04.9	53.0	39 52.7	54.1
22	245 40.0	163 58.9	52.0	182 45.0	58.7	213 06.9	53.1	54 55.1	54.1
23	260 42.4	178 58.1	52.3	197 45.6	59.1	228 09.0	53.2	69 57.5	54.1
28 00	275 44.9	193 57.2	N22 52.6	212 46.2	N20 59.4	243 11.0	N11 53.4	84 59.9	S 1 54.2
01	290 47.4	208 56.4	52.9	227 46.8	20 59.8	258 13.1	53.5	100 02.3	54.2
02	305 49.8	223 55.6	53.1	242 47.4	21 00.1	273 15.2	53.7	115 04.7	54.2
03	320 52.3	238 54.7	53.4	257 48.0	00.5	288 17.2	53.8	130 07.2	54.3
04	335 54.8	253 53.9	53.7	272 48.6	00.8	303 19.3	53.9	145 09.6	54.3
05	350 57.2	268 53.0	54.0	287 49.2	01.2	318 21.3	54.1	160 12.0	54.4
06	5 59.7	283 52.2	N22 54.2	302 49.8	N21 01.5	333 23.4	N11 54.2	175 14.4	S 1 54.4
07	21 02.2	298 51.4	54.5	317 50.4	01.9	348 25.4	54.3	190 16.8	54.4
T 08	36 04.6	313 50.5	54.8	332 51.0	02.2	3 27.5	54.5	205 19.2	54.5
U 09	51 07.1	328 49.7	55.0	347 51.7	02.6	18 29.5	54.6	220 21.6	54.5
E 10	66 09.6	343 48.8	55.3	2 52.3	02.9	33 31.6	54.7	235 24.0	54.5
S 11	81 12.0	358 48.0	55.6	17 52.9	03.3	48 33.6	54.9	250 26.4	54.6
D 12	96 14.5	13 47.1	N22 55.8	32 53.5	N21 03.6	63 35.7	N11 55.0	265 28.8	S 1 54.6
A 13	111 16.9	28 46.3	56.1	47 54.1	03.9	78 37.8	55.2	280 31.3	54.6
Y 14	126 19.4	43 45.5	56.3	62 54.7	04.3	93 39.8	55.3	295 33.7	54.7
15	141 21.9	58 44.6	56.6	77 55.3	04.6	108 41.9	55.4	310 36.1	54.7
16	156 24.3	73 43.8	56.9	92 55.9	05.0	123 43.9	55.6	325 38.5	54.7
17	171 26.8	88 42.9	57.1	107 56.5	05.3	138 46.0	55.7	340 40.9	54.8
18	186 29.3	103 42.1	N22 57.4	122 57.1	N21 05.7	153 48.0	N11 55.8	355 43.3	S 1 54.8
19	201 31.7	118 41.2	57.6	137 57.7	06.0	168 50.1	56.0	10 45.7	54.8
20	216 34.2	133 40.4	57.9	152 58.3	06.3	183 52.1	56.1	25 48.1	54.9
21	231 36.7	148 39.5	58.1	167 58.9	06.7	198 54.2	56.2	40 50.5	54.9
22	246 39.1	163 38.7	58.4	182 59.5	07.0	213 56.3	56.4	55 52.9	54.9
23	261 41.6	178 37.8	58.6	198 00.1	07.4	228 58.3	56.5	70 55.3	55.0
29 00	276 44.1	193 37.0	N22 58.9	213 00.7	N21 07.7	244 00.4	N11 56.6	85 57.7	S 1 55.0
01	291 46.5	208 36.2	59.1	228 01.3	08.1	259 02.4	56.8	101 00.2	55.0
02	306 49.0	223 35.3	59.4	243 01.9	08.4	274 04.5	56.9	116 02.6	55.1
03	321 51.4	238 34.5	59.6	258 02.5	08.7	289 06.5	57.0	131 05.0	55.1
04	336 53.9	253 33.6	22 59.8	273 03.1	09.1	304 08.6	57.2	146 07.4	55.1
05	351 56.4	268 32.8	23 00.1	288 03.7	09.4	319 10.7	57.3	161 09.8	55.2
06	6 58.8	283 31.9	N23 00.3	303 04.3	N21 09.7	334 12.7	N11 57.4	176 12.2	S 1 55.2
W 07	22 01.3	298 31.1	00.6	318 04.9	10.1	349 14.8	57.6	191 14.6	55.3
E 08	37 03.8	313 30.2	00.8	333 05.5	10.4	4 16.8	57.7	206 17.0	55.3
D 09	52 06.2	328 29.4	01.0	348 06.1	10.8	19 18.9	57.8	221 19.4	55.3
N 10	67 08.7	343 28.5	01.3	3 06.7	11.1	34 21.0	58.0	236 21.8	55.4
E 11	82 11.2	358 27.7	01.5	18 07.3	11.4	49 23.0	58.1	251 24.2	55.4
S 12	97 13.6	13 26.8	N23 01.8	33 07.9	N21 11.8	64 25.1	N11 58.2	266 26.6	S 1 55.4
D 13	112 16.1	28 26.0	02.0	48 08.5	12.1	79 27.1	58.4	281 29.0	55.5
A 14	127 18.6	43 25.1	02.2	63 09.1	12.4	94 29.2	58.5	296 31.4	55.5
Y 15	142 21.0	58 24.3	02.5	78 09.7	12.8	109 31.2	58.6	311 33.8	55.5
16	157 23.5	73 23.4	02.7	93 10.3	13.1	124 33.3	58.8	326 36.3	55.6
17	172 25.9	88 22.6	02.9	108 10.9	13.4	139 35.4	58.9	341 38.7	55.6
18	187 28.4	103 21.7	N23 03.1	123 11.5	N21 13.8	154 37.4	N11 59.0	356 41.1	S 1 55.6
19	202 30.9	118 20.9	03.4	138 12.1	14.1	169 39.5	59.2	11 43.5	55.7
20	217 33.3	133 20.0	03.6	153 12.7	14.5	184 41.5	59.3	26 45.9	55.7
21	232 35.8	148 19.2	03.8	168 13.3	14.8	199 43.6	59.4	41 48.3	55.8
22	247 38.3	163 18.3	04.0	183 13.9	15.1	214 45.7	59.6	56 50.7	55.8
23	262 40.7	178 17.5	04.3	198 14.5	15.4	229 47.7	59.7	71 53.1	55.8
Mer. Pass.	h m 5 36.1	v −0.8	d 0.3	v 0.6	d 0.3	v 2.1	d 0.1	v 2.4	d 0.0

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.3
Achernar	335 27.9	S57 10.4
Acrux	173 10.9	S63 10.2
Adhara	255 14.0	S28 59.4
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.8	N55 54.0
Alkaid	152 59.8	N49 15.5
Al Na'ir	27 45.2	S46 54.0
Alnilam	275 48.1	S 1 11.7
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.7
Alpheratz	357 44.9	N29 09.2
Altair	62 09.3	N 8 54.0
Ankaa	353 17.0	S42 14.3
Antares	112 27.6	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.2	S69 03.0
Avior	234 19.2	S59 33.0
Bellatrix	278 33.8	N 6 21.6
Betelgeuse	271 03.1	N 7 24.5
Canopus	263 57.3	S52 42.2
Capella	280 37.0	N46 00.4
Deneb	49 32.1	N45 19.3
Denebola	182 35.1	N14 30.5
Diphda	348 57.3	S17 55.2
Dubhe	193 53.6	N61 41.5
Elnath	278 14.8	N28 36.9
Eltanin	90 46.2	N51 29.3
Enif	33 48.3	N 9 55.8
Fomalhaut	15 25.3	S29 33.4
Gacrux	172 02.5	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.6	S60 26.0
Hamal	328 02.5	N23 31.0
Kaus Aust.	83 45.2	S34 22.6
Kochab	137 19.1	N74 06.7
Markab	13 39.6	N15 16.1
Menkar	314 16.7	N 4 08.1
Menkent	148 09.1	S36 25.8
Miaplacidus	221 40.8	S69 46.2
Mirfak	308 42.8	N49 53.9
Nunki	75 59.7	S26 16.8
Peacock	53 20.9	S56 41.6
Pollux	243 29.8	N27 59.8
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.4	N12 33.2
Regulus	207 45.2	N11 54.6
Rigel	281 13.7	S 8 11.3
Rigil Kent.	139 53.3	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.2	N56 35.8
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.9	S43 29.0
Vega	80 39.5	N38 47.7
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	278 12.3	11 05
Mars	297 01.3	9 49
Jupiter	327 26.1	7 46
Saturn	169 15.0	18 17

2011 JUNE 27, 28, 29 (MON., TUES., WED.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
27 00	179 16.5	N23 20.5	234 39.5	12.2	N19 09.2	7.2	54.9
01	194 16.3	20.4	249 10.7	12.1	19 16.4	7.1	54.9
02	209 16.2	20.3	263 41.8	12.0	19 23.5	6.9	54.9
03	224 16.1	20.2	278 12.8	11.9	19 30.4	7.0	54.9
04	239 15.9	20.1	292 43.7	11.9	19 37.4	6.8	55.0
05	254 15.8	20.0	307 14.6	11.8	19 44.2	6.7	55.0
06	269 15.7	N23 19.9	321 45.4	11.7	N19 50.9	6.6	55.0
07	284 15.5	19.8	336 16.1	11.7	19 57.5	6.6	55.0
08	299 15.4	19.7	350 46.8	11.6	20 04.1	6.5	55.0
M 09	314 15.3	19.6	5 17.4	11.5	20 10.6	6.3	55.1
O 10	329 15.1	19.5	19 47.9	11.4	20 16.9	6.3	55.1
N 11	344 15.0	19.4	34 18.3	11.4	20 23.2	6.2	55.1
D 12	359 14.9	N23 19.3	48 48.7	11.3	N20 29.4	6.1	55.1
A 13	14 14.8	19.2	63 19.0	11.3	20 35.5	6.0	55.1
Y 14	29 14.6	19.1	77 49.3	11.2	20 41.5	5.9	55.2
15	44 14.5	19.0	92 19.5	11.1	20 47.4	5.8	55.2
16	59 14.4	18.9	106 49.6	11.0	20 53.2	5.7	55.2
17	74 14.2	18.8	121 19.6	11.0	20 58.9	5.7	55.2
18	89 14.1	N23 18.7	135 49.6	10.9	N21 04.6	5.5	55.2
19	104 14.0	18.6	150 19.5	10.8	21 10.1	5.4	55.3
20	119 13.8	18.5	164 49.3	10.8	21 15.5	5.3	55.3
21	134 13.7	18.4	179 19.1	10.7	21 20.8	5.2	55.3
22	149 13.6	18.3	193 48.8	10.6	21 26.0	5.2	55.3
23	164 13.5	18.2	208 18.4	10.6	21 31.2	5.0	55.3
28 00	179 13.3	N23 18.1	222 48.0	10.5	N21 36.2	4.9	55.4
01	194 13.2	18.0	237 17.5	10.4	21 41.1	4.8	55.4
02	209 13.1	17.9	251 46.9	10.3	21 45.9	4.7	55.4
03	224 12.9	17.8	266 16.2	10.3	21 50.6	4.6	55.4
04	239 12.8	17.7	280 45.5	10.3	21 55.2	4.5	55.5
05	254 12.7	17.6	295 14.8	10.1	21 59.7	4.4	55.5
06	269 12.5	N23 17.4	309 43.9	10.1	N22 04.1	4.2	55.5
07	284 12.4	17.3	324 13.0	10.1	22 08.3	4.2	55.5
T 08	299 12.3	17.2	338 42.1	9.9	22 12.5	4.0	55.6
U 09	314 12.2	17.1	353 11.0	10.0	22 16.5	4.0	55.6
E 10	329 12.0	17.0	7 40.0	9.8	22 20.5	3.8	55.6
S 11	344 11.9	16.9	22 08.8	9.8	22 24.3	3.7	55.6
D 12	359 11.8	N23 16.8	36 37.6	9.7	N22 28.0	3.6	55.7
A 13	14 11.6	16.6	51 06.3	9.7	22 31.6	3.5	55.7
Y 14	29 11.5	16.5	65 35.0	9.6	22 35.1	3.4	55.7
15	44 11.4	16.4	80 03.6	9.5	22 38.5	3.3	55.7
16	59 11.3	16.3	94 32.1	9.5	22 41.8	3.1	55.7
17	74 11.1	16.2	109 00.6	9.4	22 44.9	3.0	55.8
18	89 11.0	N23 16.0	123 29.0	9.4	N22 47.9	3.0	55.8
19	104 10.9	15.9	137 57.4	9.3	22 50.9	2.7	55.8
20	119 10.7	15.8	152 25.7	9.3	22 53.6	2.7	55.8
21	134 10.6	15.7	166 54.0	9.2	22 56.3	2.6	55.9
22	149 10.5	15.6	181 22.2	9.1	22 58.9	2.4	55.9
23	164 10.4	15.4	195 50.3	9.1	23 01.3	2.3	55.9
29 00	179 10.2	N23 15.3	210 18.4	9.1	N23 03.6	2.2	55.9
01	194 10.1	15.2	224 46.5	9.0	23 05.8	2.1	56.0
02	209 10.0	15.1	239 14.5	8.9	23 07.9	1.9	56.0
03	224 09.8	14.9	253 42.4	8.9	23 09.8	1.8	56.0
04	239 09.7	14.8	268 10.3	8.9	23 11.6	1.7	56.0
05	254 09.6	14.7	282 38.2	8.7	23 13.3	1.6	56.1
06	269 09.5	N23 14.5	297 05.9	8.8	N23 14.9	1.4	56.1
W 07	284 09.3	14.4	311 33.7	8.7	23 16.3	1.4	56.1
E 08	299 09.2	14.3	326 01.4	8.7	23 17.7	1.2	56.1
D 09	314 09.1	14.2	340 29.1	8.6	23 18.9	1.0	56.2
N 10	329 09.0	14.0	354 56.7	8.5	23 19.9	1.0	56.2
E 11	344 08.8	13.9	9 24.2	8.6	23 20.9	0.8	56.2
S 12	359 08.7	N23 13.8	23 51.8	8.5	N23 21.7	0.7	56.3
D 13	14 08.6	13.6	38 19.3	8.4	23 22.4	0.5	56.3
A 14	29 08.4	13.5	52 46.7	8.4	23 22.9	0.4	56.3
Y 15	44 08.3	13.4	67 14.1	8.4	23 23.3	0.3	56.3
16	59 08.2	13.2	81 41.5	8.3	23 23.6	0.2	56.4
17	74 08.1	13.1	96 08.8	8.3	23 23.8	0.0	56.4
18	89 07.9	N23 12.9	110 36.1	8.3	N23 23.8	0.1	56.4
19	104 07.8	12.8	125 03.4	8.2	23 23.7	0.2	56.4
20	119 07.7	12.7	139 30.6	8.2	23 23.5	0.4	56.5
21	134 07.6	12.5	153 57.8	8.2	23 23.1	0.5	56.5
22	149 07.4	12.4	168 25.0	8.1	23 22.6	0.6	56.5
23	164 07.3	12.2	182 52.1	8.1	N23 22.0	0.7	56.5
	SD 15.8	d 0.1	SD	15.0		15.2	15.3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 27	Moonrise 28	Moonrise 29	Moonrise 30
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70							
68				22 04			
66				23 00	23 10	23 52	25 22
64	////	////	01 36	23 33	23 58	24 46	00 46
62	////	////	02 13	23 58	24 28	00 28	01 19
60	////	00 56	02 39	24 17	00 17	00 52	01 43
N 58	////	01 44	02 59	00 07	00 33	01 10	02 02
56	////	02 14	03 16	00 19	00 47	01 26	02 18
54	00 51	02 36	03 30	00 28	00 59	01 39	02 32
52	01 36	02 54	03 42	00 37	01 10	01 51	02 44
50	02 03	03 09	03 53	00 45	01 19	02 02	02 55
45	02 49	03 38	04 15	01 02	01 39	02 23	03 17
N 40	03 19	04 01	04 33	01 16	01 55	02 41	03 35
35	03 42	04 19	04 48	01 28	02 09	02 56	03 50
30	04 00	04 34	05 01	01 38	02 21	03 09	04 03
20	04 29	04 59	05 23	01 56	02 41	03 31	04 25
N 10	04 52	05 19	05 42	02 12	02 59	03 50	04 44
0	05 11	05 37	06 00	02 26	03 16	04 08	05 02
S 10	05 28	05 54	06 17	02 41	03 33	04 26	05 20
20	05 44	06 11	06 35	02 57	03 51	04 45	05 40
30	06 00	06 30	06 56	03 15	04 12	05 08	06 02
35	06 09	06 41	07 09	03 26	04 24	05 21	06 15
40	06 18	06 52	07 23	03 38	04 38	05 36	06 30
45	06 29	07 06	07 39	03 53	04 55	05 54	06 48
S 50	06 40	07 22	08 00	04 11	05 16	06 16	07 10
52	06 45	07 29	08 10	04 19	05 26	06 27	07 21
54	06 51	07 37	08 21	04 29	05 37	06 39	07 33
56	06 57	07 46	08 33	04 40	05 49	06 53	07 47
58	07 04	07 56	08 48	04 52	06 04	07 09	08 03
S 60	07 11	08 08	09 05	05 06	06 22	07 29	08 22

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 27	Moonset 28	Moonset 29	Moonset 30
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70							
68				19 53			
66				18 58	20 35	21 45	22 10
64	22 29	////	////	18 25	19 47	20 51	21 29
62	21 53	////	////	18 01	19 17	20 18	21 01
60	21 27	23 09	////	17 42	18 54	19 54	20 39
N 58	21 07	22 21	////	17 26	18 35	19 35	20 21
56	20 50	21 52	////	17 13	18 20	19 19	20 06
54	20 36	21 30	23 14	17 01	18 07	19 05	19 54
52	20 24	21 13	22 30	16 51	17 55	18 53	19 42
50	20 13	20 58	22 03	16 42	17 45	18 42	19 32
45	19 51	20 28	21 18	16 23	17 23	18 20	19 11
N 40	19 33	20 06	20 47	16 07	17 06	18 02	18 54
35	19 18	19 48	20 24	15 54	16 51	17 47	18 39
30	19 05	19 33	20 06	15 42	16 39	17 34	18 27
20	18 43	19 08	19 37	15 23	16 17	17 12	18 05
N 10	18 24	18 47	19 14	15 06	15 58	16 52	17 46
0	18 07	18 29	18 56	14 50	15 41	16 34	17 29
S 10	17 50	18 12	18 39	14 34	15 23	16 16	17 11
20	17 31	17 55	18 23	14 17	15 04	15 56	16 52
30	17 10	17 36	18 06	13 58	14 43	15 34	16 30
35	16 58	17 26	17 58	13 46	14 30	15 21	16 17
40	16 44	17 14	17 48	13 34	14 16	15 05	16 03
45	16 27	17 01	17 38	13 18	13 59	14 47	15 45
S 50	16 06	16 45	17 26	13 00	13 37	14 25	15 23
52	15 57	16 37	17 21	12 51	13 27	14 14	15 12
54	15 46	16 29	17 16	12 41	13 16	14 02	15 00
56	15 33	16 20	17 09	12 30	13 03	13 48	14 47
58	15 19	16 10	17 03	12 17	12 48	13 31	14 31
S 60	15 01	15 59	16 55	12 02	12 30	13 12	14 12

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
27	02 54	03 00	12 03	08 38	21 03	26	15
28	03 06	03 13	12 03	09 28	21 54	27	9
29	03 19	03 25	12 03	10 21	22 48	28	4

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.2		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
30 00	277 43.2	193 16.6	N23 04.5	213 15.1	N21 15.8	244 49.8	N11 59.8	86 55.5	S 1 55.9
01	292 45.7	208 15.8	04.7	228 15.7	16.1	259 51.9	12 00.0	101 57.9	55.9
02	307 48.1	223 14.9	04.9	243 16.3	16.4	274 53.9	00.1	117 00.3	55.9
03	322 50.6	238 14.1	05.1	258 16.9	16.8	289 56.0	00.2	132 02.7	56.0
04	337 53.0	253 13.2	05.3	273 17.5	17.1	304 58.0	00.4	147 05.1	56.0
05	352 55.5	268 12.4	05.6	288 18.1	17.4	320 00.1	00.5	162 07.5	56.1
06	7 58.0	283 11.5	N23 05.8	303 18.7	N21 17.8	335 02.2	N12 00.6	177 09.9	S 1 56.1
07	23 00.4	298 10.7	06.0	318 19.3	18.1	350 04.2	00.8	192 12.3	56.1
T 08	38 02.9	313 09.8	06.2	333 19.9	18.4	5 06.3	00.9	207 14.7	56.2
H 09	53 05.4	328 08.9	06.4	348 20.6	18.8	20 08.4	01.0	222 17.1	56.2
U 10	68 07.8	343 08.1	06.6	3 21.2	19.1	35 10.4	01.2	237 19.5	56.2
R 11	83 10.3	358 07.2	06.8	18 21.8	19.4	50 12.5	01.3	252 21.9	56.3
S 12	98 12.8	13 06.4	N23 07.0	33 22.4	N21 19.7	65 14.5	N12 01.4	267 24.3	S 1 56.3
D 13	113 15.2	28 05.5	07.2	48 23.0	20.1	80 16.6	01.6	282 26.7	56.4
A 14	128 17.7	43 04.7	07.4	63 23.6	20.4	95 18.7	01.7	297 29.1	56.4
Y 15	143 20.2	58 03.8	07.6	78 24.2	20.7	110 20.7	01.8	312 31.5	56.4
16	158 22.6	73 03.0	07.8	93 24.8	21.0	125 22.8	02.0	327 33.9	56.5
17	173 25.1	88 02.1	08.0	108 25.4	21.4	140 24.9	02.1	342 36.3	56.5
18	188 27.5	103 01.3	N23 08.2	123 26.0	N21 21.7	155 26.9	N12 02.2	357 38.7	S 1 56.5
19	203 30.0	118 00.4	08.4	138 26.6	22.0	170 29.0	02.4	12 41.1	56.6
20	218 32.5	132 59.5	08.6	153 27.2	22.3	185 31.1	02.5	27 43.5	56.6
21	233 34.9	147 58.7	08.8	168 27.8	22.7	200 33.1	02.6	42 45.9	56.7
22	248 37.4	162 57.8	09.0	183 28.4	23.0	215 35.2	02.7	57 48.3	56.7
23	263 39.9	177 57.0	09.2	198 29.0	23.3	230 37.3	02.9	72 50.7	56.7
1 00	278 42.3	192 56.1	N23 09.4	213 29.6	N21 23.6	245 39.3	N12 03.0	87 53.1	S 1 56.8
01	293 44.8	207 55.3	09.6	228 30.2	24.0	260 41.4	03.1	102 55.5	56.8
02	308 47.3	222 54.4	09.8	243 30.8	24.3	275 43.5	03.3	117 57.9	56.8
03	323 49.7	237 53.6	10.0	258 31.4	24.6	290 45.5	03.4	133 00.3	56.9
04	338 52.2	252 52.7	10.2	273 32.0	24.9	305 47.6	03.5	148 02.7	56.9
05	353 54.7	267 51.8	10.4	288 32.6	25.3	320 49.7	03.7	163 05.1	57.0
06	8 57.1	282 51.0	N23 10.5	303 33.2	N21 25.6	335 51.7	N12 03.8	178 07.5	S 1 57.0
07	23 59.6	297 50.1	10.7	318 33.8	25.9	350 53.8	03.9	193 09.9	57.0
08	39 02.0	312 49.3	10.9	333 34.4	26.2	5 55.9	04.1	208 12.3	57.1
F 09	54 04.5	327 48.4	11.1	348 35.0	26.5	20 57.9	04.2	223 14.7	57.1
R 10	69 07.0	342 47.5	11.3	3 35.6	26.9	36 00.0	04.3	238 17.1	57.2
I 11	84 09.4	357 46.7	11.5	18 36.2	27.2	51 02.1	04.4	253 19.5	57.2
D 12	99 11.9	12 45.8	N23 11.6	33 36.8	N21 27.5	66 04.1	N12 04.6	268 21.9	S 1 57.2
A 13	114 14.4	27 45.0	11.8	48 37.4	27.8	81 06.2	04.7	283 24.3	57.3
Y 14	129 16.8	42 44.1	12.0	63 38.0	28.1	96 08.3	04.8	298 26.7	57.3
15	144 19.3	57 43.3	12.2	78 38.6	28.5	111 10.3	05.0	313 29.1	57.4
16	159 21.8	72 42.4	12.3	93 39.2	28.8	126 12.4	05.1	328 31.5	57.4
17	174 24.2	87 41.5	12.5	108 39.8	29.1	141 14.5	05.2	343 33.9	57.4
18	189 26.7	102 40.7	N23 12.7	123 40.4	N21 29.4	156 16.5	N12 05.4	358 36.3	S 1 57.5
19	204 29.2	117 39.8	12.9	138 41.0	29.7	171 18.6	05.5	13 38.7	57.5
20	219 31.6	132 39.0	13.0	153 41.6	30.0	186 20.7	05.6	28 41.1	57.5
21	234 34.1	147 38.1	13.2	168 42.2	30.4	201 22.7	05.7	43 43.5	57.6
22	249 36.5	162 37.2	13.4	183 42.8	30.7	216 24.8	05.9	58 45.9	57.6
23	264 39.0	177 36.4	13.5	198 43.4	31.0	231 26.9	06.0	73 48.3	57.7
2 00	279 41.5	192 35.5	N23 13.7	213 44.0	N21 31.3	246 29.0	N12 06.1	88 50.7	S 1 57.7
01	294 43.9	207 34.7	13.8	228 44.6	31.6	261 31.0	06.3	103 53.1	57.7
02	309 46.4	222 33.8	14.0	243 45.2	31.9	276 33.1	06.4	118 55.5	57.8
03	324 48.9	237 32.9	14.2	258 45.8	32.2	291 35.2	06.5	133 57.9	57.8
04	339 51.3	252 32.1	14.3	273 46.4	32.6	306 37.2	06.6	149 00.3	57.9
05	354 53.8	267 31.2	14.5	288 47.0	32.9	321 39.3	06.8	164 02.7	57.9
06	9 56.3	282 30.3	N23 14.6	303 47.6	N21 33.2	336 41.4	N12 06.9	179 05.1	S 1 57.9
07	24 58.7	297 29.5	14.8	318 48.2	33.5	351 43.5	07.0	194 07.5	58.0
S 08	40 01.2	312 28.6	15.0	333 48.8	33.8	6 45.5	07.2	209 09.9	58.0
A 09	55 03.7	327 27.8	15.1	348 49.4	34.1	21 47.6	07.3	224 12.3	58.1
T 10	70 06.1	342 26.9	15.3	3 50.0	34.4	36 49.7	07.4	239 14.7	58.1
U 11	85 08.6	357 26.0	15.4	18 50.6	34.7	51 51.7	07.5	254 17.0	58.1
R 12	100 11.0	12 25.2	N23 15.6	33 51.2	N21 35.1	66 53.8	N12 07.7	269 19.4	S 1 58.2
D 13	115 13.5	27 24.3	15.7	48 51.8	35.4	81 55.9	07.8	284 21.8	58.2
A 14	130 16.0	42 23.4	15.9	63 52.4	35.7	96 58.0	07.9	299 24.2	58.3
Y 15	145 18.4	57 22.6	16.0	78 53.0	36.0	112 00.0	08.1	314 26.6	58.3
16	160 20.9	72 21.7	16.2	93 53.6	36.3	127 02.1	08.2	329 29.0	58.4
17	175 23.4	87 20.9	16.3	108 54.2	36.6	142 04.2	08.3	344 31.4	58.4
18	190 25.8	102 20.0	N23 16.4	123 54.8	N21 36.9	157 06.3	N12 08.4	359 33.8	S 1 58.4
19	205 28.3	117 19.1	16.6	138 55.4	37.2	172 08.3	08.6	14 36.2	58.5
20	220 30.8	132 18.3	16.7	153 56.0	37.5	187 10.4	08.7	29 38.6	58.5
21	235 33.2	147 17.4	16.9	168 56.6	37.8	202 12.5	08.8	44 41.0	58.6
22	250 35.7	162 16.5	17.0	183 57.2	38.1	217 14.5	08.9	59 43.4	58.6
23	265 38.2	177 15.7	17.1	198 57.8	38.4	232 16.6	09.1	74 45.8	58.6
	h m								
Mer. Pass.	5 24.3	*v* −0.9	*d* 0.2	*v* 0.6	*d* 0.3	*v* 2.1	*d* 0.1	*v* 2.4	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.3
Achernar	335 27.9	S57 10.3
Acrux	173 10.9	S63 10.2
Adhara	255 14.0	S28 59.4
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.8	N55 54.0
Alkaid	152 59.8	N49 15.5
Al Na'ir	27 45.1	S46 54.0
Alnilam	275 48.1	S 1 11.7
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.7
Alpheratz	357 44.9	N29 09.2
Altair	62 09.3	N 8 54.0
Ankaa	353 17.0	S42 14.3
Antares	112 27.6	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.2	S69 03.0
Avior	234 19.2	S59 33.0
Bellatrix	278 33.8	N 6 21.6
Betelgeuse	271 03.1	N 7 24.5
Canopus	263 57.3	S52 42.2
Capella	280 37.0	N46 00.4
Deneb	49 32.0	N45 19.3
Denebola	182 35.1	N14 30.5
Diphda	348 57.3	S17 55.2
Dubhe	193 53.6	N61 41.5
Elnath	278 14.7	N28 36.9
Eltanin	90 46.2	N51 29.4
Enif	33 48.2	N 9 55.8
Fomalhaut	15 25.3	S29 33.4
Gacrux	172 02.5	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.7	S60 26.0
Hamal	328 02.5	N23 31.0
Kaus Aust.	83 45.2	S34 22.6
Kochab	137 19.2	N74 06.7
Markab	13 39.6	N15 16.1
Menkar	314 16.7	N 4 08.1
Menkent	148 09.1	S36 25.8
Miaplacidus	221 40.8	S69 46.2
Mirfak	308 42.7	N49 53.9
Nunki	75 59.6	S26 16.8
Peacock	53 20.8	S56 41.6
Pollux	243 29.8	N27 59.8
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.4	N12 33.2
Regulus	207 45.2	N11 54.6
Rigel	281 13.7	S 8 11.3
Rigil Kent.	139 53.3	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.2	N56 35.9
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.9	S43 29.0
Vega	80 39.5	N38 47.8
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	274 13.8	11 09
Mars	294 47.2	9 46
Jupiter	326 57.0	7 36
Saturn	169 10.8	18 06

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
30 00	179 07.2	N23 12.1	197 19.2	8.1	N23 21.3	0.9	56.6
01	194 07.1	12.0	211 46.3	8.1	23 20.4	1.1	56.6
02	209 06.9	11.8	226 13.4	8.0	23 19.3	1.1	56.6
03	224 06.8	. . 11.7	240 40.4	8.0	23 18.2	1.3	56.6
04	239 06.7	11.5	255 07.4	8.0	23 16.9	1.4	56.7
05	254 06.6	11.4	269 34.4	8.0	23 15.5	1.6	56.7
06	269 06.4	N23 11.2	284 01.4	8.0	N23 13.9	1.7	56.7
07	284 06.3	11.1	298 28.4	7.9	23 12.2	1.8	56.8
T 08	299 06.2	10.9	312 55.3	7.9	23 10.4	2.0	56.8
H 09	314 06.1	. . 10.8	327 22.2	7.9	23 08.4	2.1	56.8
U 10	329 05.9	10.7	341 49.1	7.9	23 06.3	2.2	56.8
R 11	344 05.8	10.5	356 16.0	7.9	23 04.1	2.4	56.9
S 12	359 05.7	N23 10.4	10 42.9	7.8	N23 01.7	2.5	56.9
D 13	14 05.6	10.2	25 09.7	7.9	22 59.2	2.6	56.9
A 14	29 05.4	10.0	39 36.6	7.8	22 56.6	2.8	56.9
Y 15	44 05.3	. . 09.9	54 03.4	7.8	22 53.8	2.9	57.0
16	59 05.2	09.7	68 30.2	7.9	22 50.9	3.1	57.0
17	74 05.1	09.6	82 57.1	7.8	22 47.8	3.1	57.0
18	89 04.9	N23 09.4	97 23.9	7.8	N22 44.7	3.4	57.0
19	104 04.8	09.3	111 50.7	7.8	22 41.3	3.4	57.1
20	119 04.7	09.1	126 17.5	7.8	22 37.9	3.6	57.1
21	134 04.6	. . 09.0	140 44.3	7.8	22 34.3	3.7	57.1
22	149 04.4	08.8	155 11.1	7.8	22 30.6	3.9	57.1
23	164 04.3	08.7	169 37.9	7.8	22 26.7	3.9	57.2
1 00	179 04.2	N23 08.5	184 04.7	7.8	N22 22.8	4.2	57.2
01	194 04.1	08.3	198 31.5	7.8	22 18.6	4.2	57.2
02	209 03.9	08.2	212 58.3	7.8	22 14.4	4.4	57.2
03	224 03.8	. . 08.0	227 25.1	7.9	22 10.0	4.5	57.3
04	239 03.7	07.9	241 52.0	7.8	22 05.5	4.7	57.3
05	254 03.6	07.7	256 18.8	7.8	N22 00.8	4.7	57.3
06	269 03.5	N23 07.5					
07	284 03.3	07.4					
08	299 03.2	07.2	A partial eclipse of the Sun occurs on this date. See page 5.				
F 09	314 03.1	. . 07.0					
R 10	329 03.0	06.9					
I 11	344 02.8	06.7					
D 12	359 02.7	N23 06.5	357 26.9	7.9	N21 24.6	5.7	57.5
A 13	14 02.6	06.4	11 53.8	7.9	21 18.9	5.8	57.5
Y 14	29 02.5	06.2	26 20.7	8.0	21 13.1	6.0	57.5
15	44 02.4	. . 06.0	40 47.7	8.0	21 07.1	6.1	57.6
16	59 02.2	05.9	55 14.7	8.0	21 01.0	6.2	57.6
17	74 02.1	05.7	69 41.7	8.0	20 54.8	6.3	57.6
18	89 02.0	N23 05.5	84 08.7	8.0	N20 48.5	6.5	57.6
19	104 01.9	05.4	98 35.7	8.1	20 42.0	6.6	57.7
20	119 01.8	05.2	113 02.8	8.1	20 35.4	6.7	57.7
21	134 01.6	. . 05.0	127 29.9	8.1	20 28.7	6.8	57.7
22	149 01.5	04.8	141 57.0	8.1	20 21.9	7.0	57.7
23	164 01.4	04.7	156 24.1	8.2	20 14.9	7.1	57.8
2 00	179 01.3	N23 04.5	170 51.3	8.1	N20 07.8	7.2	57.8
01	194 01.1	04.3	185 18.4	8.2	20 00.6	7.3	57.8
02	209 01.0	04.1	199 45.6	8.3	19 53.3	7.5	57.8
03	224 00.9	. . 04.0	214 12.9	8.2	19 45.8	7.6	57.8
04	239 00.8	03.8	228 40.1	8.3	19 38.2	7.7	57.9
05	254 00.7	03.6	243 07.4	8.4	19 30.5	7.8	57.9
06	269 00.5	N23 03.4	257 34.8	8.3	N19 22.7	7.9	57.9
07	284 00.4	03.2	272 02.1	8.4	19 14.8	8.1	57.9
S 08	299 00.3	03.1	286 29.5	8.4	19 06.7	8.1	58.0
A 09	314 00.2	. . 02.9	300 56.9	8.5	18 58.6	8.3	58.0
T 10	329 00.1	02.7	315 24.4	8.5	18 50.3	8.4	58.0
U 11	343 59.9	02.5	329 51.9	8.5	18 41.9	8.5	58.0
R 12	358 59.8	N23 02.3	344 19.4	8.5	N18 33.4	8.6	58.0
D 13	13 59.7	02.1	358 46.9	8.6	18 24.8	8.8	58.1
A 14	28 59.6	02.0	13 14.5	8.6	18 16.0	8.8	58.1
Y 15	43 59.5	. . 01.8	27 42.1	8.7	18 07.2	9.0	58.1
16	58 59.4	01.6	42 09.8	8.7	17 58.2	9.0	58.1
17	73 59.2	01.4	56 37.5	8.7	17 49.2	9.2	58.2
18	88 59.1	N23 01.2	71 05.2	8.8	N17 40.0	9.3	58.2
19	103 59.0	01.0	85 33.0	8.8	17 30.7	9.4	58.2
20	118 58.9	00.8	100 00.8	8.8	17 21.3	9.5	58.2
21	133 58.8	. . 00.6	114 28.6	8.9	17 11.8	9.6	58.2
22	148 58.6	00.4	128 56.5	8.9	17 02.2	9.7	58.3
23	163 58.5	00.3	143 24.4	8.9	N16 52.5	9.8	58.3
	SD 15.8	d 0.2	SD 15.5		15.7		15.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 30	Moonrise 1	Moonrise 2	Moonrise 3
°	h m	h m	h m	h m	h m	h m	h m
N 72							03 28
N 70						01 07	04 12
68						02 33	04 41
66	////	////	00 15	25 22	01 22	03 11	05 02
64	////	////	01 40	00 46	02 03	03 38	05 20
62	////	////	02 16	01 19	02 31	03 58	05 33
60	////	01 02	02 42	01 43	02 52	04 15	05 45
N 58	////	01 48	03 02	02 02	03 09	04 29	05 55
56	////	02 17	03 18	02 18	03 24	04 41	06 04
54	00 57	02 38	03 32	02 32	03 37	04 51	06 12
52	01 39	02 56	03 44	02 44	03 48	05 01	06 19
50	02 06	03 10	03 55	02 55	03 58	05 09	06 25
45	02 50	03 40	04 17	03 17	04 18	05 27	06 39
N 40	03 20	04 02	04 35	03 35	04 35	05 41	06 50
35	03 43	04 20	04 49	03 50	04 49	05 53	06 59
30	04 02	04 35	05 02	04 03	05 01	06 04	07 08
20	04 30	05 00	05 24	04 25	05 22	06 22	07 22
N 10	04 53	05 20	05 43	04 44	05 41	06 37	07 34
0	05 11	05 38	06 00	05 02	05 57	06 52	07 46
S 10	05 28	05 55	06 17	05 20	06 14	07 07	07 57
20	05 44	06 12	06 36	05 40	06 32	07 22	08 09
30	06 00	06 30	06 57	06 02	06 53	07 40	08 23
35	06 09	06 41	07 09	06 15	07 05	07 51	08 31
40	06 18	06 52	07 23	06 30	07 19	08 03	08 41
45	06 28	07 06	07 39	06 48	07 36	08 16	08 51
S 50	06 40	07 21	08 00	07 10	07 56	08 33	09 04
52	06 45	07 29	08 09	07 21	08 06	08 41	09 10
54	06 51	07 37	08 20	07 33	08 16	08 50	09 17
56	06 57	07 46	08 33	07 47	08 29	09 00	09 24
58	07 03	07 56	08 47	08 03	08 43	09 11	09 32
S 60	07 11	08 07	09 04	08 22	08 59	09 24	09 41

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 30	Moonset 1	Moonset 2	Moonset 3
°	h m	h m	h m	h m	h m	h m	h m
N 72						23 54	23 07
N 70						{00 21 / 23 09}	22 45
68					22 55	22 39	22 29
66	23 43	////	////	22 10	22 16	22 16	22 15
64	22 26	////	////	21 29	21 48	21 58	22 04
62	21 50	////	////	21 01	21 27	21 43	21 54
60	21 25	23 03	////	20 39	21 10	21 31	21 46
N 58	21 05	22 19	////	20 21	20 55	21 20	21 38
56	20 49	21 50	////	20 06	20 43	21 10	21 32
54	20 35	21 29	23 08	19 54	20 32	21 02	21 26
52	20 23	21 11	22 27	19 42	20 22	20 54	21 20
50	20 13	20 57	22 01	19 32	20 14	20 47	21 16
45	19 50	20 28	21 17	19 11	19 55	20 33	21 05
N 40	19 33	20 05	20 47	18 54	19 40	20 21	20 56
35	19 18	19 48	20 24	18 39	19 27	20 10	20 49
30	19 05	19 33	20 06	18 27	19 16	20 01	20 42
20	18 43	19 08	19 37	18 05	18 57	19 45	20 30
N 10	18 25	18 48	19 15	17 46	18 40	19 31	20 20
0	18 07	18 30	18 56	17 29	18 24	19 18	20 10
S 10	17 50	18 13	18 39	17 11	18 08	19 05	20 01
20	17 32	17 56	18 23	16 52	17 51	18 50	19 50
30	17 11	17 37	18 07	16 30	17 31	18 34	19 38
35	16 59	17 27	17 59	16 17	17 19	18 24	19 31
40	16 45	17 15	17 49	16 03	17 06	18 13	19 23
45	16 29	17 02	17 39	15 45	16 50	18 01	19 14
S 50	16 08	16 46	17 28	15 23	16 30	17 45	19 02
52	15 58	16 39	17 23	15 12	16 21	17 37	18 57
54	15 48	16 31	17 17	15 00	16 11	17 29	18 51
56	15 35	16 22	17 11	14 47	15 59	17 20	18 44
58	15 21	16 12	17 05	14 31	15 45	17 09	18 37
S 60	15 04	16 01	16 57	14 12	15 29	16 57	18 29

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
30	03 31	03 37	12 04	11 16	23 43	29	1
1	03 43	03 49	12 04	12 11	24 38	00	0
2	03 55	04 00	12 04	13 05	00 38	01	2

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.3		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
3 00	280 40.6	192 14.8	N23 17.3	213 58.4	N21 38.8	247 18.7	N12 09.2	89 48.2	S 1 58.7
01	295 43.1	207 13.9	17.4	228 59.0	39.1	262 20.8	09.3	104 50.6	58.7
02	310 45.5	222 13.1	17.6	243 59.6	39.4	277 22.8	09.5	119 53.0	58.8
03	325 48.0	237 12.2	17.7	259 00.2	39.7	292 24.9	09.6	134 55.3	58.8
04	340 50.5	252 11.3	17.8	274 00.8	40.0	307 27.0	09.7	149 57.7	58.8
05	355 52.9	267 10.5	17.9	289 01.4	40.3	322 29.1	09.8	165 00.1	58.9
06	10 55.4	282 09.6	N23 18.1	304 02.0	N21 40.6	337 31.2	N12 10.0	180 02.5	S 1 58.9
07	25 57.9	297 08.8	18.2	319 02.6	40.9	352 33.2	10.1	195 04.9	59.0
08	41 00.3	312 07.9	18.3	334 03.2	41.2	7 35.3	10.2	210 07.3	59.0
S 09	56 02.8	327 07.0	18.5	349 03.8	41.5	22 37.4	10.3	225 09.7	59.1
U 10	71 05.3	342 06.2	18.6	4 04.4	41.8	37 39.5	10.5	240 12.1	59.1
N 11	86 07.7	357 05.3	18.7	19 05.0	42.1	52 41.5	10.6	255 14.5	59.1
D 12	101 10.2	12 04.4	N23 18.8	34 05.6	N21 42.4	67 43.6	N12 10.7	270 16.9	S 1 59.2
A 13	116 12.6	27 03.6	18.9	49 06.2	42.7	82 45.7	10.8	285 19.3	59.2
Y 14	131 15.1	42 02.7	19.1	64 06.8	43.0	97 47.8	11.0	300 21.6	59.3
15	146 17.6	57 01.8	19.2	79 07.4	43.3	112 49.8	11.1	315 24.0	59.3
16	161 20.0	72 01.0	19.3	94 08.0	43.6	127 51.9	11.2	330 26.4	59.4
17	176 22.5	87 00.1	19.4	109 08.6	43.9	142 54.0	11.4	345 28.8	59.4
18	191 25.0	101 59.2	N23 19.5	124 09.2	N21 44.2	157 56.1	N12 11.5	0 31.2	S 1 59.4
19	206 27.4	116 58.4	19.6	139 09.8	44.5	172 58.2	11.6	15 33.6	59.5
20	221 29.9	131 57.5	19.8	154 10.4	44.8	188 00.2	11.7	30 36.0	59.5
21	236 32.4	146 56.6	19.9	169 11.0	45.1	203 02.3	11.9	45 38.4	59.6
22	251 34.8	161 55.8	20.0	184 11.6	45.4	218 04.4	12.0	60 40.8	59.6
23	266 37.3	176 54.9	20.1	199 12.2	45.7	233 06.5	12.1	75 43.2	59.7
4 00	281 39.8	191 54.0	N23 20.2	214 12.8	N21 46.0	248 08.6	N12 12.2	90 45.5	S 1 59.7
01	296 42.2	206 53.2	20.3	229 13.4	46.3	263 10.6	12.4	105 47.9	59.7
02	311 44.7	221 52.3	20.4	244 14.0	46.6	278 12.7	12.5	120 50.3	59.8
03	326 47.1	236 51.4	20.5	259 14.6	46.9	293 14.8	12.6	135 52.7	59.8
04	341 49.6	251 50.6	20.6	274 15.2	47.2	308 16.9	12.7	150 55.1	59.9
05	356 52.1	266 49.7	20.7	289 15.8	47.5	323 19.0	12.9	165 57.5	1 59.9
06	11 54.5	281 48.8	N23 20.8	304 16.4	N21 47.8	338 21.0	N12 13.0	180 59.9	S 2 00.0
07	26 57.0	296 47.9	20.9	319 17.0	48.1	353 23.1	13.1	196 02.3	00.0
08	41 59.5	311 47.1	21.0	334 17.6	48.4	8 25.2	13.2	211 04.7	00.0
M 09	57 01.9	326 46.2	21.1	349 18.2	48.7	23 27.3	13.4	226 07.0	00.1
O 10	72 04.4	341 45.3	21.2	4 18.8	48.9	38 29.4	13.5	241 09.4	00.1
N 11	87 06.9	356 44.5	21.3	19 19.4	49.2	53 31.4	13.6	256 11.8	00.2
D 12	102 09.3	11 43.6	N23 21.4	34 20.0	N21 49.5	68 33.5	N12 13.7	271 14.2	S 2 00.2
A 13	117 11.8	26 42.7	21.5	49 20.6	49.8	83 35.6	13.8	286 16.6	00.3
Y 14	132 14.3	41 41.9	21.6	64 21.2	50.1	98 37.7	14.0	301 19.0	00.3
15	147 16.7	56 41.0	21.7	79 21.8	50.4	113 39.8	14.1	316 21.4	00.3
16	162 19.2	71 40.1	21.8	94 22.4	50.7	128 41.8	14.2	331 23.8	00.4
17	177 21.6	86 39.3	21.9	109 23.0	51.0	143 43.9	14.3	346 26.1	00.4
18	192 24.1	101 38.4	N23 21.9	124 23.6	N21 51.3	158 46.0	N12 14.5	1 28.5	S 2 00.5
19	207 26.6	116 37.5	22.0	139 24.2	51.6	173 48.1	14.6	16 30.9	00.5
20	222 29.0	131 36.6	22.1	154 24.8	51.9	188 50.2	14.7	31 33.3	00.6
21	237 31.5	146 35.8	22.2	169 25.4	52.2	203 52.3	14.8	46 35.7	00.6
22	252 34.0	161 34.9	22.3	184 26.0	52.4	218 54.3	15.0	61 38.1	00.7
23	267 36.4	176 34.0	22.4	199 26.6	52.7	233 56.4	15.1	76 40.5	00.7
5 00	282 38.9	191 33.2	N23 22.4	214 27.2	N21 53.0	248 58.5	N12 15.2	91 42.8	S 2 00.7
01	297 41.4	206 32.3	22.5	229 27.8	53.3	264 00.6	15.3	106 45.2	00.8
02	312 43.8	221 31.4	22.6	244 28.4	53.6	279 02.7	15.5	121 47.6	00.8
03	327 46.3	236 30.6	22.7	259 29.0	53.9	294 04.8	15.6	136 50.0	00.9
04	342 48.7	251 29.7	22.7	274 29.6	54.2	309 06.9	15.7	151 52.4	00.9
05	357 51.2	266 28.8	22.8	289 30.2	54.5	324 08.9	15.8	166 54.8	01.0
06	12 53.7	281 27.9	N23 22.9	304 30.8	N21 54.7	339 11.0	N12 15.9	181 57.1	S 2 01.0
07	27 56.1	296 27.1	23.0	319 31.4	55.0	354 13.1	16.1	196 59.5	01.1
T 08	42 58.6	311 26.2	23.0	334 32.0	55.3	9 15.2	16.2	212 01.9	01.1
U 09	58 01.1	326 25.3	23.1	349 32.6	55.6	24 17.3	16.3	227 04.3	01.1
E 10	73 03.5	341 24.5	23.2	4 33.2	55.9	39 19.4	16.4	242 06.7	01.2
S 11	88 06.0	356 23.6	23.2	19 33.8	56.2	54 21.5	16.6	257 09.1	01.2
D 12	103 08.5	11 22.7	N23 23.3	34 34.4	N21 56.5	69 23.5	N12 16.7	272 11.5	S 2 01.3
A 13	118 10.9	26 21.8	23.4	49 35.0	56.7	84 25.6	16.8	287 13.8	01.3
Y 14	133 13.4	41 21.0	23.4	64 35.6	57.0	99 27.7	16.9	302 16.2	01.4
15	148 15.9	56 20.1	23.5	79 36.2	57.3	114 29.8	17.0	317 18.6	01.4
16	163 18.3	71 19.2	23.5	94 36.8	57.6	129 31.9	17.2	332 21.0	01.5
17	178 20.8	86 18.4	23.6	109 37.4	57.9	144 34.0	17.3	347 23.4	01.5
18	193 23.2	101 17.5	N23 23.7	124 38.0	N21 58.2	159 36.1	N12 17.4	2 25.7	S 2 01.5
19	208 25.7	116 16.6	23.7	139 38.6	58.4	174 38.2	17.5	17 28.1	01.6
20	223 28.2	131 15.7	23.8	154 39.2	58.7	189 40.2	17.7	32 30.5	01.6
21	238 30.6	146 14.9	23.8	169 39.8	59.0	204 42.3	17.8	47 32.9	01.7
22	253 33.1	161 14.0	23.9	184 40.4	59.3	219 44.4	17.9	62 35.3	01.7
23	268 35.6	176 13.1	23.9	199 41.0	59.6	234 46.5	18.0	77 37.7	01.8
	h m								
Mer. Pass.	5 12.5	*v* −0.9	*d* 0.1	*v* 0.6	*d* 0.3	*v* 2.1	*d* 0.1	*v* 2.4	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.3
Achernar	335 27.9	S57 10.3
Acrux	173 11.0	S63 10.2
Adhara	255 14.0	S28 59.3
Aldebaran	290 51.3	N16 31.9
Alioth	166 21.8	N55 54.0
Alkaid	152 59.8	N49 15.5
Al Na'ir	27 45.1	S46 54.0
Alnilam	275 48.1	S 1 11.7
Alphard	217 57.7	S 8 42.7
Alphecca	126 11.9	N26 40.7
Alpheratz	357 44.9	N29 09.2
Altair	62 09.3	N 8 54.1
Ankaa	353 17.0	S42 14.3
Antares	112 27.6	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.2	S69 03.0
Avior	234 19.2	S59 33.0
Bellatrix	278 33.8	N 6 21.6
Betelgeuse	271 03.1	N 7 24.5
Canopus	263 57.3	S52 42.1
Capella	280 36.9	N46 00.4
Deneb	49 32.0	N45 19.3
Denebola	182 35.1	N14 30.5
Diphda	348 57.2	S17 55.2
Dubhe	193 53.6	N61 41.5
Elnath	278 14.7	N28 36.9
Eltanin	90 46.2	N51 29.4
Enif	33 48.2	N 9 55.8
Fomalhaut	15 25.3	S29 33.4
Gacrux	172 02.5	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.7	S60 26.0
Hamal	328 02.5	N23 31.0
Kaus Aust.	83 45.2	S34 22.6
Kochab	137 19.2	N74 06.7
Markab	13 39.6	N15 16.1
Menkar	314 16.7	N 4 08.1
Menkent	148 09.1	S36 25.8
Miaplacidus	221 40.8	S69 46.2
Mirfak	308 42.7	N49 53.9
Nunki	75 59.6	S26 16.8
Peacock	53 20.8	S56 41.6
Pollux	243 29.8	N27 59.8
Procyon	245 01.5	N 5 11.6
Rasalhague	96 07.4	N12 33.2
Regulus	207 45.2	N11 54.6
Rigel	281 13.7	S 8 11.3
Rigil Kent.	139 53.3	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.1	N56 35.9
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.9	S43 29.0
Vega	80 39.5	N38 47.8
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	270 14.3	11 13
Mars	292 33.0	9 43
Jupiter	326 28.8	7 26
Saturn	169 05.8	17 54

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
3 00	178 58.4	N23 00.1	157 52.3	9.0	N16 42.7	9.9	58.3
01	193 58.3	22 59.9	172 20.3	9.0	16 32.8	10.0	58.3
02	208 58.2	59.7	186 48.3	9.1	16 22.8	10.1	58.3
03	223 58.1	. . 59.5	201 16.4	9.1	16 12.7	10.2	58.3
04	238 57.9	59.3	215 44.5	9.1	16 02.5	10.3	58.4
05	253 57.8	59.1	230 12.6	9.2	15 52.2	10.4	58.4
06	268 57.7	N22 58.9	244 40.8	9.2	N15 41.8	10.5	58.4
07	283 57.6	58.7	259 09.0	9.3	15 31.3	10.5	58.4
08	298 57.5	58.5	273 37.3	9.3	15 20.8	10.7	58.4
S 09	313 57.4	. . 58.3	288 05.6	9.3	15 10.1	10.8	58.5
U 10	328 57.2	58.1	302 33.9	9.4	14 59.3	10.8	58.5
N 11	343 57.1	57.9	317 02.3	9.4	14 48.5	11.0	58.5
D 12	358 57.0	N22 57.7	331 30.7	9.4	N14 37.5	11.0	58.5
A 13	13 56.9	57.5	345 59.1	9.5	14 26.5	11.1	58.5
Y 14	28 56.8	57.3	0 27.6	9.5	14 15.4	11.3	58.5
15	43 56.7	. . 57.1	14 56.1	9.6	14 04.1	11.2	58.6
16	58 56.5	56.9	29 24.7	9.6	13 52.9	11.4	58.6
17	73 56.4	56.7	43 53.3	9.6	13 41.5	11.5	58.6
18	88 56.3	N22 56.5	58 21.9	9.7	N13 30.0	11.5	58.6
19	103 56.2	56.3	72 50.6	9.7	13 18.5	11.6	58.6
20	118 56.1	56.1	87 19.3	9.8	13 06.9	11.7	58.6
21	133 56.0	. . 55.9	101 48.1	9.8	12 55.2	11.8	58.7
22	148 55.9	55.7	116 16.9	9.8	12 43.4	11.9	58.7
23	163 55.7	55.5	130 45.7	9.9	12 31.5	11.9	58.7
4 00	178 55.6	N22 55.2	145 14.6	9.9	N12 19.6	12.0	58.7
01	193 55.5	55.0	159 43.5	9.9	12 07.6	12.1	58.7
02	208 55.4	54.8	174 12.4	10.0	11 55.5	12.1	58.7
03	223 55.3	. . 54.6	188 41.4	10.0	11 43.4	12.2	58.8
04	238 55.2	54.4	203 10.4	10.0	11 31.2	12.3	58.8
05	253 55.1	54.2	217 39.4	10.1	11 18.9	12.3	58.8
06	268 54.9	N22 54.0	232 08.5	10.1	N11 06.6	12.5	58.8
07	283 54.8	53.8	246 37.6	10.1	10 54.1	12.4	58.8
08	298 54.7	53.6	261 06.7	10.2	10 41.7	12.6	58.8
M 09	313 54.6	. . 53.3	275 35.9	10.2	10 29.1	12.6	58.8
O 10	328 54.5	53.1	290 05.1	10.2	10 16.5	12.7	58.9
N 11	343 54.4	52.9	304 34.3	10.3	10 03.8	12.7	58.9
D 12	358 54.3	N22 52.7	319 03.6	10.3	N 9 51.1	12.8	58.9
A 13	13 54.1	52.5	333 32.9	10.3	9 38.3	12.8	58.9
Y 14	28 54.0	52.3	348 02.2	10.4	9 25.5	12.9	58.9
15	43 53.9	. . 52.0	2 31.6	10.3	9 12.6	13.0	58.9
16	58 53.8	51.8	17 00.9	10.4	8 59.6	13.0	58.9
17	73 53.7	51.6	31 30.3	10.5	8 46.6	13.0	58.9
18	88 53.6	N22 51.4	45 59.8	10.5	N 8 33.6	13.2	59.0
19	103 53.5	51.2	60 29.3	10.4	8 20.4	13.1	59.0
20	118 53.4	50.9	74 58.7	10.6	8 07.3	13.2	59.0
21	133 53.3	. . 50.7	89 28.3	10.5	7 54.1	13.3	59.0
22	148 53.1	50.5	103 57.8	10.6	7 40.8	13.3	59.0
23	163 53.0	50.3	118 27.4	10.6	7 27.5	13.3	59.0
5 00	178 52.9	N22 50.0	132 57.0	10.6	N 7 14.2	13.4	59.0
01	193 52.8	49.8	147 26.6	10.6	7 00.8	13.4	59.0
02	208 52.7	49.6	161 56.2	10.7	6 47.4	13.5	59.0
03	223 52.6	. . 49.4	176 25.9	10.7	6 33.9	13.5	59.0
04	238 52.5	49.1	190 55.6	10.7	6 20.4	13.6	59.1
05	253 52.4	48.9	205 25.3	10.7	6 06.8	13.5	59.1
06	268 52.3	N22 48.7	219 55.0	10.7	N 5 53.3	13.7	59.1
07	283 52.1	48.4	234 24.7	10.8	5 39.6	13.6	59.1
T 08	298 52.0	48.2	248 54.5	10.7	5 26.0	13.7	59.1
U 09	313 51.9	. . 48.0	263 24.2	10.8	5 12.3	13.7	59.1
E 10	328 51.8	47.7	277 54.0	10.8	4 58.6	13.8	59.1
S 11	343 51.7	47.5	292 23.8	10.8	4 44.8	13.7	59.1
D 12	358 51.6	N22 47.3	306 53.6	10.9	N 4 31.1	13.8	59.1
A 13	13 51.5	47.0	321 23.5	10.8	4 17.3	13.9	59.1
Y 14	28 51.4	46.8	335 53.3	10.9	4 03.4	13.8	59.1
15	43 51.3	. . 46.6	350 23.2	10.8	3 49.6	13.9	59.2
16	58 51.2	46.3	4 53.0	10.9	3 35.7	13.9	59.2
17	73 51.1	46.1	19 22.9	10.9	3 21.8	13.9	59.2
18	88 50.9	N22 45.9	33 52.8	10.9	N 3 07.9	13.9	59.2
19	103 50.8	45.6	48 22.7	10.9	2 54.0	14.0	59.2
20	118 50.7	45.4	62 52.6	10.9	2 40.0	14.0	59.2
21	133 50.6	. . 45.1	77 22.5	10.9	2 26.0	14.0	59.2
22	148 50.5	44.9	91 52.4	11.0	2 12.0	14.0	59.2
23	163 50.4	44.7	106 22.4	10.9	N 1 58.0	14.0	59.2
	SD 15.8	d 0.2	SD	15.9		16.0	16.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 3	Moonrise 4	Moonrise 5	Moonrise 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	03 28	06 06	08 20	10 28
N 70	▭	▭	▭	04 12	06 25	08 28	10 27
68	▭	▭	▭	04 41	06 40	08 34	10 26
66	////	////	00 39	05 02	06 52	08 39	10 25
64	////	////	01 46	05 20	07 02	08 44	10 25
62	////	////	02 20	05 33	07 11	08 47	10 24
60	////	01 10	02 45	05 45	07 18	08 51	10 23
N 58	////	01 52	03 05	05 55	07 24	08 54	10 23
56	////	02 20	03 21	06 04	07 30	08 56	10 23
54	01 04	02 41	03 34	06 12	07 35	08 59	10 22
52	01 44	02 58	03 46	06 19	07 40	09 01	10 22
50	02 09	03 13	03 57	06 25	07 44	09 03	10 22
45	02 53	03 42	04 19	06 39	07 53	09 07	10 21
N 40	03 22	04 04	04 36	06 50	08 00	09 10	10 20
35	03 45	04 21	04 51	06 59	08 06	09 13	10 20
30	04 03	04 36	05 04	07 08	08 12	09 16	10 19
20	04 32	05 01	05 25	07 22	08 21	09 20	10 19
N 10	04 54	05 21	05 44	07 34	08 30	09 24	10 18
0	05 12	05 38	06 01	07 46	08 37	09 28	10 18
S 10	05 29	05 55	06 18	07 57	08 45	09 32	10 17
20	05 44	06 12	06 36	08 09	08 54	09 36	10 17
30	06 00	06 30	06 56	08 23	09 03	09 40	10 16
35	06 09	06 41	07 09	08 31	09 08	09 43	10 16
40	06 18	06 52	07 22	08 41	09 14	09 46	10 16
45	06 28	07 05	07 39	08 51	09 22	09 49	10 15
S 50	06 39	07 21	07 59	09 04	09 30	09 53	10 15
52	06 44	07 28	08 08	09 10	09 34	09 55	10 15
54	06 50	07 36	08 19	09 17	09 38	09 57	10 14
56	06 56	07 44	08 31	09 24	09 43	09 59	10 14
58	07 02	07 54	08 45	09 32	09 48	10 02	10 14
S 60	07 09	08 06	09 02	09 41	09 54	10 04	10 14

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 3	Moonset 4	Moonset 5	Moonset 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	23 07	22 39	22 17	21 56
N 70	▭	▭	▭	22 45	22 29	22 15	22 01
68	▭	▭	▭	22 29	22 20	22 13	22 05
66	23 24	////	////	22 15	22 13	22 11	22 08
64	22 21	////	////	22 04	22 07	22 09	22 11
62	21 47	////	////	21 54	22 02	22 08	22 14
60	21 23	22 56	////	21 46	21 57	22 07	22 16
N 58	21 03	22 15	////	21 38	21 53	22 06	22 18
56	20 47	21 48	////	21 32	21 49	22 05	22 20
54	20 34	21 27	23 02	21 26	21 46	22 04	22 21
52	20 22	21 10	22 24	21 20	21 43	22 03	22 22
50	20 12	20 55	21 59	21 16	21 40	22 02	22 24
45	19 50	20 27	21 15	21 05	21 34	22 00	22 27
N 40	19 32	20 05	20 46	20 56	21 29	21 59	22 29
35	19 18	19 47	20 24	20 49	21 24	21 58	22 31
30	19 05	19 32	20 05	20 42	21 20	21 57	22 33
20	18 44	19 08	19 37	20 30	21 13	21 55	22 36
N 10	18 25	18 48	19 15	20 20	21 07	21 53	22 39
0	18 08	18 30	18 57	20 10	21 02	21 52	22 41
S 10	17 51	18 14	18 40	20 01	20 56	21 50	22 44
20	17 33	17 57	18 24	19 50	20 49	21 48	22 47
30	17 12	17 39	18 08	19 38	20 42	21 46	22 50
35	17 00	17 28	18 00	19 31	20 38	21 45	22 52
40	16 47	17 17	17 51	19 23	20 33	21 44	22 54
45	16 30	17 04	17 41	19 14	20 28	21 42	22 56
S 50	16 10	16 48	17 30	19 02	20 21	21 40	22 59
52	16 01	16 41	17 25	18 57	20 18	21 39	23 00
54	15 50	16 33	17 19	18 51	20 15	21 38	23 02
56	15 38	16 25	17 13	18 44	20 11	21 37	23 03
58	15 24	16 15	17 07	18 37	20 06	21 36	23 05
S 60	15 07	16 03	17 00	18 29	20 02	21 34	23 07

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
3	04 06	04 12	12 04	13 58	01 32	02	6
4	04 17	04 23	12 04	14 50	02 24	03	12
5	04 28	04 33	12 05	15 40	03 15	04	20

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.3		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
6 00	283 38.0	191 12.3	N23 24.0	214 41.6	N21 59.8	249 48.6	N12 18.1	92 40.0	S 2 01.8
01	298 40.5	206 11.4	24.0	229 42.2	22 00.1	264 50.7	18.3	107 42.4	01.9
02	313 43.0	221 10.5	24.1	244 42.8	00.4	279 52.8	18.4	122 44.8	01.9
03	328 45.4	236 09.6	24.1	259 43.4	00.7	294 54.9	18.5	137 47.2	02.0
04	343 47.9	251 08.8	24.2	274 44.0	01.0	309 57.0	18.6	152 49.6	02.0
05	358 50.4	266 07.9	24.2	289 44.6	01.2	324 59.0	18.7	167 51.9	02.1
06	13 52.8	281 07.0	N23 24.3	304 45.2	N22 01.5	340 01.1	N12 18.9	182 54.3	S 2 02.1
W 07	28 55.3	296 06.2	24.3	319 45.8	01.8	355 03.2	19.0	197 56.7	02.1
E 08	43 57.7	311 05.3	24.4	334 46.4	02.1	10 05.3	19.1	212 59.1	02.2
D 09	59 00.2	326 04.4	24.4	349 47.0	02.4	25 07.4	19.2	228 01.5	02.2
N 10	74 02.7	341 03.5	24.4	4 47.6	02.6	40 09.5	19.3	243 03.9	02.3
E 11	89 05.1	356 02.7	24.5	19 48.2	02.9	55 11.6	19.5	258 06.2	02.3
S 12	104 07.6	11 01.8	N23 24.5	34 48.8	N22 03.2	70 13.7	N12 19.6	273 08.6	S 2 02.4
D 13	119 10.1	26 00.9	24.5	49 49.4	03.5	85 15.8	19.7	288 11.0	02.4
A 14	134 12.5	41 00.0	24.6	64 50.0	03.7	100 17.9	19.8	303 13.4	02.5
Y 15	149 15.0	55 59.2	24.6	79 50.6	04.0	115 20.0	19.9	318 15.8	02.5
16	164 17.5	70 58.3	24.6	94 51.2	04.3	130 22.0	20.1	333 18.1	02.6
17	179 19.9	85 57.4	24.7	109 51.8	04.6	145 24.1	20.2	348 20.5	02.6
18	194 22.4	100 56.6	N23 24.7	124 52.4	N22 04.8	160 26.2	N12 20.3	3 22.9	S 2 02.7
19	209 24.8	115 55.7	24.7	139 53.0	05.1	175 28.3	20.4	18 25.3	02.7
20	224 27.3	130 54.8	24.8	154 53.6	05.4	190 30.4	20.5	33 27.6	02.8
21	239 29.8	145 53.9	24.8	169 54.2	05.6	205 32.5	20.7	48 30.0	02.8
22	254 32.2	160 53.1	24.8	184 54.8	05.9	220 34.6	20.8	63 32.4	02.8
23	269 34.7	175 52.2	24.8	199 55.4	06.2	235 36.7	20.9	78 34.8	02.9
7 00	284 37.2	190 51.3	N23 24.9	214 56.0	N22 06.5	250 38.8	N12 21.0	93 37.2	S 2 02.9
01	299 39.6	205 50.4	24.9	229 56.6	06.7	265 40.9	21.1	108 39.5	03.0
02	314 42.1	220 49.6	24.9	244 57.2	07.0	280 43.0	21.3	123 41.9	03.0
03	329 44.6	235 48.7	24.9	259 57.8	07.3	295 45.1	21.4	138 44.3	03.1
04	344 47.0	250 47.8	24.9	274 58.4	07.5	310 47.2	21.5	153 46.7	03.1
05	359 49.5	265 46.9	25.0	289 59.0	07.8	325 49.3	21.6	168 49.0	03.2
06	14 52.0	280 46.1	N23 25.0	304 59.6	N22 08.1	340 51.4	N12 21.7	183 51.4	S 2 03.2
T 07	29 54.4	295 45.2	25.0	320 00.2	08.3	355 53.4	21.8	198 53.8	03.3
H 08	44 56.9	310 44.3	25.0	335 00.8	08.6	10 55.5	22.0	213 56.2	03.3
U 09	59 59.3	325 43.5	25.0	350 01.4	08.9	25 57.6	22.1	228 58.6	03.4
R 10	75 01.8	340 42.6	25.0	5 02.0	09.2	40 59.7	22.2	244 00.9	03.4
S 11	90 04.3	355 41.7	25.0	20 02.6	09.4	56 01.8	22.3	259 03.3	03.5
D 12	105 06.7	10 40.8	N23 25.0	35 03.2	N22 09.7	71 03.9	N12 22.4	274 05.7	S 2 03.5
A 13	120 09.2	25 40.0	25.0	50 03.8	10.0	86 06.0	22.6	289 08.1	03.6
Y 14	135 11.7	40 39.1	25.0	65 04.4	10.2	101 08.1	22.7	304 10.4	03.6
15	150 14.1	55 38.2	25.0	80 05.0	10.5	116 10.2	22.8	319 12.8	03.7
16	165 16.6	70 37.3	25.1	95 05.6	10.8	131 12.3	22.9	334 15.2	03.7
17	180 19.1	85 36.5	25.1	110 06.2	11.0	146 14.4	23.0	349 17.6	03.8
18	195 21.5	100 35.6	N23 25.1	125 06.8	N22 11.3	161 16.5	N12 23.1	4 19.9	S 2 03.8
19	210 24.0	115 34.7	25.1	140 07.4	11.5	176 18.6	23.3	19 22.3	03.9
20	225 26.5	130 33.8	25.1	155 08.0	11.8	191 20.7	23.4	34 24.7	03.9
21	240 28.9	145 33.0	25.1	170 08.6	12.1	206 22.8	23.5	49 27.1	04.0
22	255 31.4	160 32.1	25.0	185 09.2	12.3	221 24.9	23.6	64 29.4	04.0
23	270 33.8	175 31.2	25.0	200 09.8	12.6	236 27.0	23.7	79 31.8	04.0
8 00	285 36.3	190 30.3	N23 25.0	215 10.4	N22 12.9	251 29.1	N12 23.8	94 34.2	S 2 04.1
01	300 38.8	205 29.5	25.0	230 11.0	13.1	266 31.2	24.0	109 36.6	04.1
02	315 41.2	220 28.6	25.0	245 11.6	13.4	281 33.3	24.1	124 38.9	04.2
03	330 43.7	235 27.7	25.0	260 12.2	13.6	296 35.4	24.2	139 41.3	04.2
04	345 46.2	250 26.8	25.0	275 12.8	13.9	311 37.5	24.3	154 43.7	04.3
05	0 48.6	265 26.0	25.0	290 13.4	14.2	326 39.6	24.4	169 46.1	04.3
06	15 51.1	280 25.1	N23 25.0	305 14.0	N22 14.4	341 41.7	N12 24.6	184 48.4	S 2 04.4
07	30 53.6	295 24.2	25.0	320 14.6	14.7	356 43.8	24.7	199 50.8	04.4
08	45 56.0	310 23.3	24.9	335 15.2	15.0	11 45.9	24.8	214 53.2	04.5
F 09	60 58.5	325 22.5	24.9	350 15.8	15.2	26 48.0	24.9	229 55.6	04.5
R 10	76 00.9	340 21.6	24.9	5 16.4	15.5	41 50.1	25.0	244 57.9	04.6
I 11	91 03.4	355 20.7	24.9	20 17.0	15.7	56 52.2	25.1	260 00.3	04.6
D 12	106 05.9	10 19.8	N23 24.9	35 17.6	N22 16.0	71 54.3	N12 25.2	275 02.7	S 2 04.7
A 13	121 08.3	25 19.0	24.8	50 18.2	16.2	86 56.4	25.4	290 05.0	04.7
Y 14	136 10.8	40 18.1	24.8	65 18.8	16.5	101 58.5	25.5	305 07.4	04.8
15	151 13.3	55 17.2	24.8	80 19.4	16.8	117 00.6	25.6	320 09.8	04.8
16	166 15.7	70 16.4	24.8	95 20.0	17.0	132 02.7	25.7	335 12.2	04.9
17	181 18.2	85 15.5	24.7	110 20.6	17.3	147 04.8	25.8	350 14.5	04.9
18	196 20.7	100 14.6	N23 24.7	125 21.2	N22 17.5	162 06.9	N12 25.9	5 16.9	S 2 05.0
19	211 23.1	115 13.7	24.7	140 21.8	17.8	177 09.0	26.1	20 19.3	05.0
20	226 25.6	130 12.9	24.7	155 22.4	18.0	192 11.1	26.2	35 21.6	05.1
21	241 28.1	145 12.0	24.6	170 23.0	18.3	207 13.2	26.3	50 24.0	05.1
22	256 30.5	160 11.1	24.6	185 23.6	18.5	222 15.3	26.4	65 26.4	05.2
23	271 33.0	175 10.2	24.6	200 24.2	18.8	237 17.4	26.5	80 28.8	05.2
	h m								
Mer. Pass.	5 00.7	*v* −0.9	*d* 0.0	*v* 0.6	*d* 0.3	*v* 2.1	*d* 0.1	*v* 2.4	*d* 0.0

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.3
Achernar	335 27.8	S57 10.3
Acrux	173 11.0	S63 10.2
Adhara	255 14.0	S28 59.3
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.8	N55 54.0
Alkaid	152 59.8	N49 15.5
Al Na'ir	27 45.1	S46 54.0
Alnilam	275 48.1	S 1 11.7
Alphard	217 57.7	S 8 42.6
Alphecca	126 11.9	N26 40.7
Alpheratz	357 44.9	N29 09.2
Altair	62 09.2	N 8 54.1
Ankaa	353 16.9	S42 14.2
Antares	112 27.6	S26 27.5
Arcturus	145 56.8	N19 07.4
Atria	107 30.2	S69 03.0
Avior	234 19.2	S59 33.0
Bellatrix	278 33.8	N 6 21.6
Betelgeuse	271 03.1	N 7 24.5
Canopus	263 57.3	S52 42.1
Capella	280 36.9	N46 00.4
Deneb	49 32.0	N45 19.3
Denebola	182 35.1	N14 30.5
Diphda	348 57.2	S17 55.2
Dubhe	193 53.6	N61 41.5
Elnath	278 14.7	N28 36.9
Eltanin	90 46.3	N51 29.4
Enif	33 48.2	N 9 55.8
Fomalhaut	15 25.3	S29 33.4
Gacrux	172 02.6	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.7	S60 26.0
Hamal	328 02.4	N23 31.0
Kaus Aust.	83 45.2	S34 22.6
Kochab	137 19.2	N74 06.7
Markab	13 39.5	N15 16.1
Menkar	314 16.7	N 4 08.1
Menkent	148 09.1	S36 25.8
Miaplacidus	221 40.9	S69 46.2
Mirfak	308 42.7	N49 53.9
Nunki	75 59.6	S26 16.8
Peacock	53 20.8	S56 41.6
Pollux	243 29.8	N27 59.8
Procyon	245 01.5	N 5 11.7
Rasalhague	96 07.4	N12 33.2
Regulus	207 45.2	N11 54.6
Rigel	281 13.7	S 8 11.3
Rigil Kent.	139 53.4	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.1	N56 35.9
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.0
Spica	158 32.7	S11 13.4
Suhail	222 53.9	S43 29.0
Vega	80 39.5	N38 47.8
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	266 14.1	11 17
Mars	290 18.8	9 40
Jupiter	326 01.6	7 16
Saturn	169 00.0	17 43

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
6 00	178 50.3	N22 44.4	120 52.3	10.9	N 1 44.0	14.0	59.2
01	193 50.2	44.2	135 22.2	10.9	1 30.0	14.0	59.2
02	208 50.1	43.9	149 52.1	11.0	1 16.0	14.1	59.2
03	223 50.0	43.7	164 22.1	10.9	1 01.9	14.0	59.2
04	238 49.9	43.4	178 52.0	10.9	0 47.9	14.1	59.2
05	253 49.8	43.2	193 21.9	11.0	0 33.8	14.0	59.2
06	268 49.7	N22 43.0	207 51.9	10.9	N 0 19.8	14.1	59.3
W 07	283 49.6	42.7	222 21.8	10.9	N 0 05.7	14.1	59.3
E 08	298 49.4	42.5	236 51.7	10.9	S 0 08.4	14.0	59.3
D 09	313 49.3	42.2	251 21.6	11.0	0 22.4	14.1	59.3
N 10	328 49.2	42.0	265 51.6	10.9	0 36.5	14.1	59.3
E 11	343 49.1	41.7	280 21.5	10.9	0 50.6	14.0	59.3
S 12	358 49.0	N22 41.5	294 51.4	10.9	S 1 04.6	14.1	59.3
D 13	13 48.9	41.2	309 21.3	10.9	1 18.7	14.0	59.3
A 14	28 48.8	41.0	323 51.2	10.8	1 32.7	14.1	59.3
Y 15	43 48.7	40.7	338 21.0	10.9	1 46.8	14.0	59.3
16	58 48.6	40.5	352 50.9	10.9	2 00.8	14.0	59.3
17	73 48.5	40.2	7 20.8	10.8	2 14.8	14.1	59.3
18	88 48.4	N22 39.9	21 50.6	10.8	S 2 28.9	14.0	59.3
19	103 48.3	39.7	36 20.4	10.8	2 42.9	13.9	59.3
20	118 48.2	39.4	50 50.2	10.8	2 56.8	14.0	59.3
21	133 48.1	39.2	65 20.0	10.8	3 10.8	14.0	59.3
22	148 48.0	38.9	79 49.8	10.8	3 24.8	13.9	59.3
23	163 47.9	38.7	94 19.6	10.7	3 38.7	13.9	59.3
7 00	178 47.8	N22 38.4	108 49.3	10.8	S 3 52.6	13.9	59.3
01	193 47.7	38.2	123 19.1	10.7	4 06.5	13.9	59.3
02	208 47.6	37.9	137 48.8	10.7	4 20.4	13.9	59.3
03	223 47.5	37.6	152 18.5	10.6	4 34.3	13.8	59.3
04	238 47.4	37.4	166 48.1	10.7	4 48.1	13.8	59.3
05	253 47.3	37.1	181 17.8	10.6	5 01.9	13.8	59.3
06	268 47.2	N22 36.8	195 47.4	10.6	S 5 15.7	13.7	59.3
T 07	283 47.1	36.6	210 17.0	10.5	5 29.4	13.7	59.3
H 08	298 47.0	36.3	224 46.5	10.6	5 43.1	13.7	59.3
U 09	313 46.8	36.1	239 16.1	10.5	5 56.8	13.7	59.3
R 10	328 46.7	35.8	253 45.6	10.5	6 10.5	13.6	59.3
S 11	343 46.6	35.5	268 15.1	10.4	6 24.1	13.6	59.3
D 12	358 46.5	N22 35.3	282 44.5	10.5	S 6 37.7	13.5	59.3
A 13	13 46.4	35.0	297 14.0	10.4	6 51.2	13.5	59.3
Y 14	28 46.3	34.7	311 43.4	10.3	7 04.7	13.5	59.3
15	43 46.2	34.5	326 12.7	10.4	7 18.2	13.4	59.3
16	58 46.1	34.2	340 42.1	10.3	7 31.6	13.4	59.3
17	73 46.0	33.9	355 11.4	10.2	7 45.0	13.3	59.3
18	88 45.9	N22 33.6	9 40.6	10.3	S 7 58.3	13.3	59.3
19	103 45.8	33.4	24 09.9	10.2	8 11.6	13.3	59.3
20	118 45.7	33.1	38 39.1	10.1	8 24.9	13.2	59.3
21	133 45.6	32.8	53 08.2	10.2	8 38.1	13.2	59.3
22	148 45.5	32.6	67 37.4	10.0	8 51.3	13.1	59.3
23	163 45.4	32.3	82 06.4	10.1	9 04.4	13.0	59.3
8 00	178 45.3	N22 32.0	96 35.5	10.0	S 9 17.4	13.0	59.3
01	193 45.2	31.7	111 04.5	10.0	9 30.4	13.0	59.3
02	208 45.1	31.5	125 33.5	9.9	9 43.4	12.9	59.3
03	223 45.0	31.2	140 02.4	9.9	9 56.3	12.8	59.3
04	238 44.9	30.9	154 31.3	9.8	10 09.1	12.8	59.3
05	253 44.9	30.6	169 00.1	9.8	10 21.9	12.7	59.3
06	268 44.8	N22 30.4	183 28.9	9.8	S10 34.6	12.7	59.3
07	283 44.7	30.1	197 57.7	9.7	10 47.3	12.6	59.3
08	298 44.6	29.8	212 26.4	9.6	10 59.9	12.5	59.3
F 09	313 44.5	29.5	226 55.0	9.7	11 12.4	12.5	59.3
R 10	328 44.4	29.2	241 23.7	9.5	11 24.9	12.4	59.3
I 11	343 44.3	28.9	255 52.2	9.6	11 37.3	12.3	59.3
D 12	358 44.2	N22 28.7	270 20.8	9.4	S11 49.6	12.3	59.3
A 13	13 44.1	28.4	284 49.2	9.5	12 01.9	12.2	59.3
Y 14	28 44.0	28.1	299 17.7	9.4	12 14.1	12.1	59.3
15	43 43.9	27.8	313 46.1	9.3	12 26.2	12.0	59.3
16	58 43.8	27.5	328 14.4	9.3	12 38.2	12.0	59.3
17	73 43.7	27.2	342 42.7	9.2	12 50.2	11.9	59.3
18	88 43.6	N22 27.0	357 10.9	9.2	S13 02.1	11.9	59.3
19	103 43.5	26.7	11 39.1	9.1	13 14.0	11.7	59.3
20	118 43.4	26.4	26 07.2	9.1	13 25.7	11.7	59.3
21	133 43.3	26.1	40 35.3	9.0	13 37.4	11.6	59.3
22	148 43.2	25.8	55 03.3	9.0	13 49.0	11.5	59.3
23	163 43.1	25.5	69 31.3	8.9	S14 00.5	11.4	59.3
	SD 15.8	d 0.3	SD 16.2		16.2		16.2

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 6	Moonrise 7	Moonrise 8	Moonrise 9
°	h m	h m	h m	h m	h m	h m	h m
N 72				10 28	12 38	14 59	18 10
N 70				10 27	12 28	14 34	16 57
68				10 26	12 19	14 16	16 20
66	////	////	00 56	10 25	12 12	14 01	15 54
64	////	////	01 53	10 25	12 06	13 49	15 35
62	////	////	02 25	10 24	12 01	13 39	15 19
60	////	01 19	02 49	10 23	11 57	13 31	15 05
N 58	////	01 58	03 08	10 23	11 53	13 23	14 54
56	////	02 24	03 24	10 23	11 49	13 17	14 44
54	01 12	02 45	03 37	10 22	11 46	13 11	14 35
52	01 48	03 01	03 49	10 22	11 43	13 05	14 27
50	02 13	03 16	03 59	10 22	11 41	13 01	14 20
45	02 55	03 44	04 21	10 21	11 35	12 50	14 05
N 40	03 25	04 06	04 38	10 20	11 31	12 42	13 53
35	03 47	04 23	04 52	10 20	11 27	12 35	13 43
30	04 05	04 38	05 05	10 19	11 24	12 28	13 34
20	04 33	05 02	05 26	10 19	11 18	12 17	13 18
N 10	04 54	05 21	05 44	10 18	11 13	12 08	13 05
0	05 13	05 39	06 01	10 18	11 08	11 59	12 53
S 10	05 29	05 55	06 18	10 17	11 03	11 50	12 40
20	05 45	06 12	06 36	10 17	10 58	11 41	12 27
30	06 00	06 30	06 56	10 16	10 53	11 31	12 12
35	06 09	06 40	07 08	10 16	10 49	11 25	12 03
40	06 18	06 51	07 22	10 16	10 46	11 18	11 54
45	06 27	07 04	07 38	10 15	10 42	11 10	11 42
S 50	06 38	07 20	07 57	10 15	10 37	11 01	11 28
52	06 43	07 27	08 07	10 15	10 35	10 56	11 22
54	06 49	07 34	08 17	10 14	10 32	10 52	11 15
56	06 54	07 43	08 29	10 14	10 29	10 47	11 07
58	07 01	07 53	08 43	10 14	10 26	10 41	10 58
S 60	07 08	08 03	08 59	10 14	10 23	10 34	10 48

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 6	Moonset 7	Moonset 8	Moonset 9
°	h m	h m	h m	h m	h m	h m	h m
N 72				21 56	21 33	21 02	19 43
N 70				22 01	21 46	21 28	20 57
68				22 05	21 57	21 48	21 35
66	23 09	////	////	22 08	22 06	22 04	22 02
64	22 15	////	////	22 11	22 14	22 17	22 23
62	21 43	////	////	22 14	22 20	22 28	22 40
60	21 20	22 49	////	22 16	22 26	22 38	22 54
N 58	21 01	22 10	////	22 18	22 31	22 46	23 06
56	20 45	21 44	////	22 20	22 35	22 54	23 17
54	20 32	21 24	22 55	22 21	22 39	23 00	23 26
52	20 20	21 08	22 20	22 22	22 43	23 06	23 35
50	20 10	20 53	21 56	22 24	22 46	23 12	23 42
45	19 49	20 25	21 14	22 27	22 54	23 24	23 58
N 40	19 32	20 04	20 45	22 29	23 00	23 34	24 11
35	19 17	19 47	20 23	22 31	23 05	23 42	24 23
30	19 05	19 32	20 05	22 33	23 10	23 49	24 33
20	18 44	19 08	19 37	22 36	23 18	24 02	00 02
N 10	18 25	18 48	19 15	22 39	23 25	24 14	00 14
0	18 09	18 31	18 57	22 41	23 32	24 24	00 24
S 10	17 52	18 14	18 41	22 44	23 39	24 35	00 35
20	17 34	17 58	18 25	22 47	23 46	24 46	00 46
30	17 14	17 40	18 10	22 50	23 54	25 00	01 00
35	17 02	17 30	18 01	22 52	23 59	25 07	01 07
40	16 48	17 19	17 52	22 54	24 05	00 05	01 16
45	16 32	17 06	17 43	22 56	24 11	00 11	01 26
S 50	16 13	16 50	17 32	22 59	24 19	00 19	01 38
52	16 03	16 43	17 27	23 00	24 22	00 22	01 44
54	15 53	16 36	17 21	23 02	24 26	00 26	01 51
56	15 41	16 27	17 16	23 03	24 30	00 30	01 58
58	15 27	16 18	17 09	23 05	24 35	00 35	02 06
S 60	15 11	16 07	17 02	23 07	24 41	00 41	02 15

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
6	04 39	04 44	12 05	16 30	04 05	05	30
7	04 49	04 54	12 05	17 20	04 55	06	41
8	04 58	05 03	12 05	18 12	05 46	07	53

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.3		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
9 00	286 35.4	190 09.4	N23 24.5	215 24.8	N22 19.1	252 19.5	N12 26.6	95 31.1	S 2 05.3
01	301 37.9	205 08.5	24.5	230 25.4	19.3	267 21.6	26.7	110 33.5	05.3
02	316 40.4	220 07.6	24.5	245 26.0	19.6	282 23.7	26.9	125 35.9	05.4
03	331 42.8	235 06.7	24.4	260 26.6	19.8	297 25.8	27.0	140 38.2	05.4
04	346 45.3	250 05.9	24.4	275 27.2	20.1	312 27.9	27.1	155 40.6	05.5
05	1 47.8	265 05.0	24.3	290 27.8	20.3	327 30.0	27.2	170 43.0	05.5
06	16 50.2	280 04.1	N23 24.3	305 28.4	N22 20.6	342 32.2	N12 27.3	185 45.4	S 2 05.6
07	31 52.7	295 03.2	24.2	320 29.0	20.8	357 34.3	27.4	200 47.7	05.6
S 08	46 55.2	310 02.4	24.2	335 29.6	21.1	12 36.4	27.6	215 50.1	05.7
A 09	61 57.6	325 01.5	24.2	350 30.2	21.3	27 38.5	27.7	230 52.5	05.7
T 10	77 00.1	340 00.6	24.1	5 30.8	21.6	42 40.6	27.8	245 54.8	05.8
U 11	92 02.6	354 59.7	24.1	20 31.4	21.8	57 42.7	27.9	260 57.2	05.8
R 12	107 05.0	9 58.9	N23 24.0	35 32.0	N22 22.1	72 44.8	N12 28.0	275 59.6	S 2 05.9
D 13	122 07.5	24 58.0	24.0	50 32.5	22.3	87 46.9	28.1	291 01.9	05.9
A 14	137 09.9	39 57.1	23.9	65 33.1	22.6	102 49.0	28.2	306 04.3	06.0
Y 15	152 12.4	54 56.2	23.9	80 33.7	22.8	117 51.1	28.4	321 06.7	06.0
16	167 14.9	69 55.4	23.8	95 34.3	23.1	132 53.2	28.5	336 09.0	06.1
17	182 17.3	84 54.5	23.7	110 34.9	23.3	147 55.3	28.6	351 11.4	06.2
18	197 19.8	99 53.6	N23 23.7	125 35.5	N22 23.6	162 57.4	N12 28.7	6 13.8	S 2 06.2
19	212 22.3	114 52.7	23.6	140 36.1	23.8	177 59.5	28.8	21 16.2	06.3
20	227 24.7	129 51.9	23.6	155 36.7	24.1	193 01.6	28.9	36 18.5	06.3
21	242 27.2	144 51.0	23.5	170 37.3	24.3	208 03.7	29.0	51 20.9	06.4
22	257 29.7	159 50.1	23.5	185 37.9	24.5	223 05.9	29.1	66 23.3	06.4
23	272 32.1	174 49.2	23.4	200 38.5	24.8	238 08.0	29.3	81 25.6	06.5
10 00	287 34.6	189 48.4	N23 23.3	215 39.1	N22 25.0	253 10.1	N12 29.4	96 28.0	S 2 06.5
01	302 37.0	204 47.5	23.3	230 39.7	25.3	268 12.2	29.5	111 30.4	06.6
02	317 39.5	219 46.6	23.2	245 40.3	25.5	283 14.3	29.6	126 32.7	06.6
03	332 42.0	234 45.8	23.1	260 40.9	25.8	298 16.4	29.7	141 35.1	06.7
04	347 44.4	249 44.9	23.1	275 41.5	26.0	313 18.5	29.8	156 37.5	06.7
05	2 46.9	264 44.0	23.0	290 42.1	26.3	328 20.6	29.9	171 39.8	06.8
06	17 49.4	279 43.1	N23 22.9	305 42.7	N22 26.5	343 22.7	N12 30.0	186 42.2	S 2 06.8
07	32 51.8	294 42.3	22.8	320 43.3	26.7	358 24.8	30.2	201 44.6	06.9
08	47 54.3	309 41.4	22.8	335 43.9	27.0	13 26.9	30.3	216 46.9	06.9
S 09	62 56.8	324 40.5	22.7	350 44.5	27.2	28 29.1	30.4	231 49.3	07.0
U 10	77 59.2	339 39.6	22.6	5 45.1	27.5	43 31.2	30.5	246 51.7	07.0
N 11	93 01.7	354 38.8	22.5	20 45.7	27.7	58 33.3	30.6	261 54.0	07.1
D 12	108 04.2	9 37.9	N23 22.5	35 46.3	N22 27.9	73 35.4	N12 30.7	276 56.4	S 2 07.1
A 13	123 06.6	24 37.0	22.4	50 46.9	28.2	88 37.5	30.8	291 58.8	07.2
Y 14	138 09.1	39 36.1	22.3	65 47.5	28.4	103 39.6	30.9	307 01.1	07.2
15	153 11.5	54 35.3	22.2	80 48.1	28.7	118 41.7	31.1	322 03.5	07.3
16	168 14.0	69 34.4	22.1	95 48.7	28.9	133 43.8	31.2	337 05.8	07.3
17	183 16.5	84 33.5	22.1	110 49.3	29.1	148 46.0	31.3	352 08.2	07.4
18	198 18.9	99 32.6	N23 22.0	125 49.9	N22 29.4	163 48.1	N12 31.4	7 10.6	S 2 07.5
19	213 21.4	114 31.8	21.9	140 50.5	29.6	178 50.2	31.5	22 12.9	07.5
20	228 23.9	129 30.9	21.8	155 51.1	29.9	193 52.3	31.6	37 15.3	07.6
21	243 26.3	144 30.0	21.7	170 51.7	30.1	208 54.4	31.7	52 17.7	07.6
22	258 28.8	159 29.2	21.6	185 52.3	30.3	223 56.5	31.8	67 20.0	07.7
23	273 31.3	174 28.3	21.5	200 52.9	30.6	238 58.6	31.9	82 22.4	07.7
11 00	288 33.7	189 27.4	N23 21.4	215 53.5	N22 30.8	254 00.7	N12 32.1	97 24.8	S 2 07.8
01	303 36.2	204 26.5	21.3	230 54.1	31.0	269 02.9	32.2	112 27.1	07.8
02	318 38.7	219 25.7	21.3	245 54.7	31.3	284 05.0	32.3	127 29.5	07.9
03	333 41.1	234 24.8	21.2	260 55.3	31.5	299 07.1	32.4	142 31.9	07.9
04	348 43.6	249 23.9	21.1	275 55.9	31.7	314 09.2	32.5	157 34.2	08.0
05	3 46.0	264 23.0	21.0	290 56.5	32.0	329 11.3	32.6	172 36.6	08.0
06	18 48.5	279 22.2	N23 20.9	305 57.1	N22 32.2	344 13.4	N12 32.7	187 38.9	S 2 08.1
07	33 51.0	294 21.3	20.8	320 57.8	32.4	359 15.5	32.8	202 41.3	08.1
08	48 53.4	309 20.4	20.7	335 58.4	32.7	14 17.7	32.9	217 43.7	08.2
M 09	63 55.9	324 19.5	20.6	350 59.0	32.9	29 19.8	33.1	232 46.0	08.3
O 10	78 58.4	339 18.7	20.5	5 59.6	33.1	44 21.9	33.2	247 48.4	08.3
N 11	94 00.8	354 17.8	20.3	21 00.2	33.4	59 24.0	33.3	262 50.8	08.4
D 12	109 03.3	9 16.9	N23 20.2	36 00.8	N22 33.6	74 26.1	N12 33.4	277 53.1	S 2 08.4
A 13	124 05.8	24 16.1	20.1	51 01.4	33.8	89 28.2	33.5	292 55.5	08.5
Y 14	139 08.2	39 15.2	20.0	66 02.0	34.1	104 30.4	33.6	307 57.8	08.5
15	154 10.7	54 14.3	19.9	81 02.6	34.3	119 32.5	33.7	323 00.2	08.6
16	169 13.2	69 13.4	19.8	96 03.2	34.5	134 34.6	33.8	338 02.6	08.6
17	184 15.6	84 12.6	19.7	111 03.8	34.8	149 36.7	33.9	353 04.9	08.7
18	199 18.1	99 11.7	N23 19.6	126 04.4	N22 35.0	164 38.8	N12 34.0	8 07.3	S 2 08.7
19	214 20.5	114 10.8	19.5	141 05.0	35.2	179 40.9	34.2	23 09.6	08.8
20	229 23.0	129 10.0	19.3	156 05.6	35.5	194 43.1	34.3	38 12.0	08.8
21	244 25.5	144 09.1	19.2	171 06.2	35.7	209 45.2	34.4	53 14.4	08.9
22	259 27.9	159 08.2	19.1	186 06.8	35.9	224 47.3	34.5	68 16.7	09.0
23	274 30.4	174 07.3	19.0	201 07.4	36.1	239 49.4	34.6	83 19.1	09.0
Mer. Pass.	h m 4 48.9	v −0.9	d 0.1	v 0.6	d 0.2	v 2.1	d 0.1	v 2.4	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.6	S40 15.3
Achernar	335 27.8	S57 10.3
Acrux	173 11.0	S63 10.2
Adhara	255 14.0	S28 59.3
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.8	N55 54.0
Alkaid	152 59.8	N49 15.5
Al Na'ir	27 45.0	S46 54.0
Alnilam	275 48.1	S 1 11.7
Alphard	217 57.7	S 8 42.6
Alphecca	126 11.9	N26 40.7
Alpheratz	357 44.8	N29 09.2
Altair	62 09.2	N 8 54.1
Ankaa	353 16.9	S42 14.2
Antares	112 27.6	S26 27.5
Arcturus	145 56.9	N19 07.4
Atria	107 30.2	S69 03.0
Avior	234 19.2	S59 33.0
Bellatrix	278 33.8	N 6 21.6
Betelgeuse	271 03.1	N 7 24.5
Canopus	263 57.3	S52 42.1
Capella	280 36.9	N46 00.4
Deneb	49 32.0	N45 19.3
Denebola	182 35.2	N14 30.5
Diphda	348 57.2	S17 55.2
Dubhe	193 53.6	N61 41.5
Elnath	278 14.7	N28 36.9
Eltanin	90 46.3	N51 29.4
Enif	33 48.2	N 9 55.8
Fomalhaut	15 25.2	S29 33.4
Gacrux	172 02.6	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.7	S60 26.0
Hamal	328 02.4	N23 31.0
Kaus Aust.	83 45.2	S34 22.6
Kochab	137 19.3	N74 06.7
Markab	13 39.5	N15 16.1
Menkar	314 16.6	N 4 08.1
Menkent	148 09.1	S36 25.8
Miaplacidus	221 40.9	S69 46.1
Mirfak	308 42.6	N49 53.9
Nunki	75 59.6	S26 16.8
Peacock	53 20.8	S56 41.6
Pollux	243 29.8	N27 59.8
Procyon	245 01.5	N 5 11.7
Rasalhague	96 07.4	N12 33.2
Regulus	207 45.2	N11 54.6
Rigel	281 13.7	S 8 11.3
Rigil Kent.	139 53.4	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.1	N56 35.9
Shaula	96 23.4	S37 06.7
Sirius	258 35.3	S16 44.0
Spica	158 32.7	S11 13.4
Suhail	222 53.9	S43 29.0
Vega	80 39.5	N38 47.8
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	262 13.8	11 21
Mars	288 04.6	9 37
Jupiter	325 35.5	7 06
Saturn	168 53.4	17 31

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
9 00	178 43.0	N22 25.2	83 59.2	8.9	S14 11.9	11.4	59.2
01	193 42.9	24.9	98 27.1	8.8	14 23.3	11.2	59.2
02	208 42.8	24.6	112 54.9	8.8	14 34.5	11.2	59.2
03	223 42.7	24.3	127 22.7	8.7	14 45.7	11.1	59.2
04	238 42.6	24.1	141 50.4	8.7	14 56.8	11.0	59.2
05	253 42.5	23.8	156 18.1	8.6	15 07.8	10.9	59.2
06	268 42.5	N22 23.5	170 45.7	8.5	S15 18.7	10.8	59.2
07	283 42.4	23.2	185 13.2	8.5	15 29.5	10.7	59.2
S 08	298 42.3	22.9	199 40.7	8.4	15 40.2	10.6	59.2
A 09	313 42.2	22.6	214 08.1	8.4	15 50.8	10.5	59.2
T 10	328 42.1	22.3	228 35.5	8.3	16 01.3	10.5	59.2
U 11	343 42.0	22.0	243 02.8	8.3	16 11.8	10.3	59.2
R 12	358 41.9	N22 21.7	257 30.1	8.2	S16 22.1	10.2	59.2
D 13	13 41.8	21.4	271 57.3	8.2	16 32.3	10.2	59.2
A 14	28 41.7	21.1	286 24.5	8.1	16 42.5	10.0	59.2
Y 15	43 41.6	20.8	300 51.6	8.0	16 52.5	9.9	59.2
16	58 41.5	20.5	315 18.6	8.0	17 02.4	9.9	59.2
17	73 41.4	20.2	329 45.6	8.0	17 12.3	9.7	59.1
18	88 41.3	N22 19.9	344 12.6	7.9	S17 22.0	9.6	59.1
19	103 41.2	19.6	358 39.5	7.8	17 31.6	9.5	59.1
20	118 41.2	19.3	13 06.3	7.8	17 41.1	9.4	59.1
21	133 41.1	19.0	27 33.1	7.7	17 50.5	9.3	59.1
22	148 41.0	18.7	41 59.8	7.7	17 59.8	9.1	59.1
23	163 40.9	18.4	56 26.5	7.6	18 08.9	9.1	59.1
10 00	178 40.8	N22 18.0	70 53.1	7.5	S18 18.0	8.9	59.1
01	193 40.7	17.7	85 19.6	7.5	18 26.9	8.9	59.1
02	208 40.6	17.4	99 46.1	7.5	18 35.8	8.7	59.1
03	223 40.5	17.1	114 12.6	7.4	18 44.5	8.6	59.1
04	238 40.4	16.8	128 39.0	7.3	18 53.1	8.5	59.1
05	253 40.3	16.5	143 05.3	7.3	19 01.6	8.3	59.0
06	268 40.3	N22 16.2	157 31.6	7.3	S19 09.9	8.3	59.0
07	283 40.2	15.9	171 57.9	7.1	19 18.2	8.1	59.0
08	298 40.1	15.6	186 24.0	7.2	19 26.3	8.0	59.0
S 09	313 40.0	15.3	200 50.2	7.1	19 34.3	7.9	59.0
U 10	328 39.9	14.9	215 16.3	7.0	19 42.2	7.7	59.0
N 11	343 39.8	14.6	229 42.3	7.0	19 49.9	7.6	59.0
D 12	358 39.7	N22 14.3	244 08.3	6.9	S19 57.5	7.5	59.0
A 13	13 39.6	14.0	258 34.2	6.9	20 05.0	7.4	59.0
Y 14	28 39.6	13.7	273 00.1	6.9	20 12.4	7.3	59.0
15	43 39.5	13.4	287 26.0	6.8	20 19.7	7.1	58.9
16	58 39.4	13.1	301 51.8	6.8	20 26.8	6.9	58.9
17	73 39.3	12.7	316 17.6	6.7	20 33.7	6.9	58.9
18	88 39.2	N22 12.4	330 43.3	6.6	S20 40.6	6.7	58.9
19	103 39.1	12.1	345 08.9	6.7	20 47.3	6.6	58.9
20	118 39.0	11.8	359 34.6	6.6	20 53.9	6.5	58.9
21	133 38.9	11.5	14 00.2	6.5	21 00.4	6.3	58.9
22	148 38.9	11.1	28 25.7	6.5	21 06.7	6.2	58.9
23	163 38.8	10.8	42 51.2	6.5	21 12.9	6.0	58.9
11 00	178 38.7	N22 10.5	57 16.7	6.4	S21 18.9	5.9	58.8
01	193 38.6	10.2	71 42.1	6.4	21 24.8	5.8	58.8
02	208 38.5	09.8	86 07.5	6.3	21 30.6	5.6	58.8
03	223 38.4	09.5	100 32.8	6.4	21 36.2	5.5	58.8
04	238 38.3	09.2	114 58.2	6.3	21 41.7	5.4	58.8
05	253 38.3	08.9	129 23.5	6.2	21 47.1	5.2	58.8
06	268 38.2	N22 08.5	143 48.7	6.2	S21 52.3	5.1	58.8
07	283 38.1	08.2	158 13.9	6.2	21 57.4	4.9	58.8
08	298 38.0	07.9	172 39.1	6.2	22 02.3	4.8	58.7
M 09	313 37.9	07.6	187 04.3	6.1	22 07.1	4.7	58.7
O 10	328 37.8	07.2	201 29.4	6.1	22 11.8	4.5	58.7
N 11	343 37.8	06.9	215 54.5	6.1	22 16.3	4.3	58.7
D 12	358 37.7	N22 06.6	230 19.6	6.1	S22 20.6	4.2	58.7
A 13	13 37.6	06.2	244 44.7	6.0	22 24.8	4.1	58.7
Y 14	28 37.5	05.9	259 09.7	6.0	22 28.9	3.9	58.7
15	43 37.4	05.6	273 34.7	6.0	22 32.8	3.8	58.7
16	58 37.3	05.2	287 59.7	6.0	22 36.6	3.6	58.6
17	73 37.3	04.9	302 24.7	6.0	22 40.2	3.5	58.6
18	88 37.2	N22 04.6	316 49.7	5.9	S22 43.7	3.4	58.6
19	103 37.1	04.2	331 14.6	6.0	22 47.1	3.2	58.6
20	118 37.0	03.9	345 39.6	5.9	22 50.3	3.0	58.6
21	133 36.9	03.6	0 04.5	5.9	22 53.3	2.9	58.6
22	148 36.9	03.2	14 29.4	5.9	22 56.2	2.8	58.6
23	163 36.8	02.9	28 54.3	5.9	S22 59.0	2.6	58.5
	SD 15.8	d 0.3	SD 16.1		16.1		16.0

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 9	Moonrise 10	Moonrise 11	Moonrise 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	18 10	▬	▬	▬
N 70	▭	▭	▭	16 57	▬	▬	▬
68	▭	▭	▭	16 20	18 43	▬	▬
66	////	////	01 11	15 54	17 51	19 45	21 06
64	////	////	02 00	15 35	17 19	18 55	20 06
62	////	////	02 31	15 19	16 56	18 24	19 32
60	////	01 28	02 54	15 05	16 37	18 01	19 07
N 58	////	02 04	03 12	14 54	16 22	17 42	18 47
56	////	02 29	03 27	14 44	16 09	17 26	18 31
54	01 21	02 49	03 40	14 35	15 57	17 13	18 17
52	01 54	03 05	03 52	14 27	15 47	17 01	18 05
50	02 18	03 19	04 02	14 20	15 38	16 50	17 54
45	02 59	03 46	04 23	14 05	15 19	16 29	17 31
N 40	03 27	04 08	04 40	13 53	15 04	16 11	17 13
35	03 49	04 25	04 54	13 43	14 51	15 56	16 58
30	04 06	04 39	05 06	13 34	14 40	15 44	16 44
20	04 34	05 03	05 27	13 18	14 20	15 22	16 22
N 10	04 55	05 22	05 45	13 05	14 04	15 03	16 02
0	05 13	05 39	06 02	12 53	13 48	14 46	15 44
S 10	05 29	05 56	06 18	12 40	13 33	14 28	15 26
20	05 45	06 12	06 36	12 27	13 16	14 10	15 07
30	06 00	06 30	06 56	12 12	12 58	13 48	14 44
35	06 08	06 40	07 07	12 03	12 47	13 36	14 31
40	06 17	06 51	07 21	11 54	12 34	13 22	14 16
45	06 26	07 03	07 36	11 42	12 20	13 05	13 58
S 50	06 37	07 18	07 56	11 28	12 02	12 44	13 36
52	06 42	07 25	08 05	11 22	11 54	12 34	13 25
54	06 47	07 32	08 15	11 15	11 44	12 23	13 13
56	06 53	07 41	08 27	11 07	11 34	12 10	12 59
58	06 59	07 50	08 40	10 58	11 22	11 56	12 43
S 60	07 06	08 01	08 56	10 48	11 08	11 38	12 24

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 9	Moonset 10	Moonset 11	Moonset 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	19 43	▬	▬	▬
N 70	▭	▭	▭	20 57	▬	▬	▬
68	▭	▭	▭	21 35	21 11	▬	▬
66	22 56	////	////	22 02	22 03	22 09	22 51
64	22 08	////	////	22 23	22 35	23 00	23 51
62	21 38	////	////	22 40	22 59	23 31	24 25
60	21 16	22 40	////	22 54	23 18	23 55	24 50
N 58	20 58	22 05	////	23 06	23 34	24 14	00 14
56	20 42	21 40	////	23 17	23 48	24 30	00 30
54	20 30	21 21	22 48	23 26	24 00	00 00	00 44
52	20 18	21 05	22 15	23 35	24 10	00 10	00 56
50	20 08	20 51	21 52	23 42	24 19	00 19	01 06
45	19 47	20 24	21 11	23 58	24 39	00 39	01 28
N 40	19 31	20 03	20 43	24 11	00 11	00 55	01 46
35	19 16	19 46	20 22	24 23	00 23	01 09	02 01
30	19 04	19 31	20 04	24 33	00 33	01 21	02 14
20	18 43	19 08	19 37	00 02	00 50	01 41	02 36
N 10	18 26	18 48	19 15	00 14	01 05	01 59	02 56
0	18 09	18 31	18 57	00 24	01 19	02 15	03 14
S 10	17 53	18 15	18 41	00 35	01 33	02 32	03 32
20	17 35	17 59	18 26	00 46	01 48	02 50	03 51
30	17 15	17 41	18 11	01 00	02 05	03 10	04 13
35	17 03	17 31	18 03	01 07	02 15	03 22	04 26
40	16 50	17 20	17 54	01 16	02 27	03 36	04 41
45	16 35	17 08	17 45	01 26	02 41	03 53	04 59
S 50	16 15	16 53	17 34	01 38	02 57	04 13	05 21
52	16 06	16 46	17 29	01 44	03 05	04 23	05 32
54	15 56	16 39	17 24	01 51	03 14	04 33	05 44
56	15 44	16 30	17 18	01 58	03 24	04 46	05 57
58	15 31	16 21	17 12	02 06	03 35	05 00	06 13
S 60	15 15	16 10	17 06	02 15	03 49	05 17	06 33

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
9	05 08	05 12	12 05	19 06	06 38	08	64
10	05 17	05 21	12 05	20 02	07 33	09	75
11	05 25	05 29	12 05	21 00	08 31	10	84

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.3		SATURN +0.9		STARS		
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Name	SHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
12 00	289 32.9	189 06.5	N23 18.9	216 08.0	N22 36.4	254 51.5	N12 34.7	98 21.5	S 2 09.1	Acamar	315 19.5	S40 15.2
01	304 35.3	204 05.6	18.7	231 08.6	36.6	269 53.7	34.8	113 23.8	09.1	Achernar	335 27.8	S57 10.3
02	319 37.8	219 04.7	18.6	246 09.2	36.8	284 55.8	34.9	128 26.2	09.2	Acrux	173 11.0	S63 10.2
03	334 40.3	234 03.9 . .	18.5	261 09.8 . .	37.0	299 57.9 . .	35.0	143 28.5 . .	09.2	Adhara	255 14.0	S28 59.3
04	349 42.7	249 03.0	18.4	276 10.4	37.3	315 00.0	35.1	158 30.9	09.3	Aldebaran	290 51.2	N16 31.9
05	4 45.2	264 02.1	18.2	291 11.0	37.5	330 02.1	35.2	173 33.3	09.3			
06	19 47.6	279 01.2	N23 18.1	306 11.6	N22 37.7	345 04.3	N12 35.3	188 35.6	S 2 09.4	Alioth	166 21.9	N55 54.0
07	34 50.1	294 00.4	18.0	321 12.2	37.9	0 06.4	35.5	203 38.0	09.4	Alkaid	152 59.8	N49 15.5
T 08	49 52.6	308 59.5	17.9	336 12.8	38.2	15 08.5	35.6	218 40.3	09.5	Al Na'ir	27 45.0	S46 54.0
U 09	64 55.0	323 58.6 . .	17.7	351 13.4 . .	38.4	30 10.6 . .	35.7	233 42.7 . .	09.6	Alnilam	275 48.0	S 1 11.7
E 10	79 57.5	338 57.8	17.6	6 14.0	38.6	45 12.7	35.8	248 45.0	09.6	Alphard	217 57.7	S 8 42.6
S 11	95 00.0	353 56.9	17.5	21 14.6	38.8	60 14.9	35.9	263 47.4	09.7			
D 12	110 02.4	8 56.0	N23 17.3	36 15.2	N22 39.1	75 17.0	N12 36.0	278 49.8	S 2 09.7	Alphecca	126 11.9	N26 40.7
A 13	125 04.9	23 55.1	17.2	51 15.8	39.3	90 19.1	36.1	293 52.1	09.8	Alpheratz	357 44.8	N29 09.2
Y 14	140 07.4	38 54.3	17.0	66 16.4	39.5	105 21.2	36.2	308 54.5	09.8	Altair	62 09.2	N 8 54.1
15	155 09.8	53 53.4 . .	16.9	81 17.0 . .	39.7	120 23.3 . .	36.3	323 56.8 . .	09.9	Ankaa	353 16.9	S42 14.2
16	170 12.3	68 52.5	16.8	96 17.6	40.0	135 25.5	36.4	338 59.2	09.9	Antares	112 27.6	S26 27.5
17	185 14.8	83 51.7	16.6	111 18.2	40.2	150 27.6	36.5	354 01.6	10.0			
18	200 17.2	98 50.8	N23 16.5	126 18.8	N22 40.4	165 29.7	N12 36.6	9 03.9	S 2 10.1	Arcturus	145 56.9	N19 07.4
19	215 19.7	113 49.9	16.3	141 19.4	40.6	180 31.8	36.8	24 06.3	10.1	Atria	107 30.2	S69 03.0
20	230 22.1	128 49.0	16.2	156 20.0	40.8	195 34.0	36.9	39 08.6	10.2	Avior	234 19.2	S59 33.0
21	245 24.6	143 48.2 . .	16.0	171 20.6 . .	41.1	210 36.1 . .	37.0	54 11.0 . .	10.2	Bellatrix	278 33.8	N 6 21.6
22	260 27.1	158 47.3	15.9	186 21.2	41.3	225 38.2	37.1	69 13.3	10.3	Betelgeuse	271 03.1	N 7 24.5
23	275 29.5	173 46.4	15.8	201 21.8	41.5	240 40.3	37.2	84 15.7	10.3			
13 00	290 32.0	188 45.6	N23 15.6	216 22.4	N22 41.7	255 42.5	N12 37.3	99 18.1	S 2 10.4	Canopus	263 57.3	S52 42.1
01	305 34.5	203 44.7	15.5	231 23.0	41.9	270 44.6	37.4	114 20.4	10.4	Capella	280 36.9	N46 00.4
02	320 36.9	218 43.8	15.3	246 23.6	42.1	285 46.7	37.5	129 22.8	10.5	Deneb	49 32.0	N45 19.4
03	335 39.4	233 43.0 . .	15.1	261 24.2 . .	42.4	300 48.8 . .	37.6	144 25.1 . .	10.6	Denebola	182 35.2	N14 30.5
04	350 41.9	248 42.1	15.0	276 24.8	42.6	315 50.9	37.7	159 27.5	10.6	Diphda	348 57.2	S17 55.2
05	5 44.3	263 41.2	14.8	291 25.4	42.8	330 53.1	37.8	174 29.8	10.7			
06	20 46.8	278 40.4	N23 14.7	306 26.0	N22 43.0	345 55.2	N12 37.9	189 32.2	S 2 10.7	Dubhe	193 53.7	N61 41.5
W 07	35 49.3	293 39.5	14.5	321 26.6	43.2	0 57.3	38.0	204 34.6	10.8	Elnath	278 14.7	N28 36.9
E 08	50 51.7	308 38.6	14.4	336 27.2	43.4	15 59.5	38.1	219 36.9	10.8	Eltanin	90 46.3	N51 29.4
D 09	65 54.2	323 37.7 . .	14.2	351 27.8 . .	43.7	31 01.6 . .	38.2	234 39.3 . .	10.9	Enif	33 48.2	N 9 55.8
N 10	80 56.6	338 36.9	14.0	6 28.4	43.9	46 03.7	38.4	249 41.6	11.0	Fomalhaut	15 25.2	S29 33.4
E 11	95 59.1	353 36.0	13.9	21 29.0	44.1	61 05.8	38.5	264 44.0	11.0			
S 12	111 01.6	8 35.1	N23 13.7	36 29.6	N22 44.3	76 08.0	N12 38.6	279 46.3	S 2 11.1	Gacrux	172 02.6	S57 11.0
D 13	126 04.0	23 34.3	13.5	51 30.2	44.5	91 10.1	38.7	294 48.7	11.1	Gienah	175 53.8	S17 36.5
A 14	141 06.5	38 33.4	13.4	66 30.8	44.7	106 12.2	38.8	309 51.0	11.2	Hadar	148 49.7	S60 26.0
Y 15	156 09.0	53 32.5 . .	13.2	81 31.4 . .	44.9	121 14.3 . .	38.9	324 53.4 . .	11.2	Hamal	328 02.4	N23 31.0
16	171 11.4	68 31.7	13.0	96 32.0	45.2	136 16.5	39.0	339 55.7	11.3	Kaus Aust.	83 45.2	S34 22.7
17	186 13.9	83 30.8	12.9	111 32.6	45.4	151 18.6	39.1	354 58.1	11.4			
18	201 16.4	98 29.9	N23 12.7	126 33.2	N22 45.6	166 20.7	N12 39.2	10 00.5	S 2 11.4	Kochab	137 19.4	N74 06.7
19	216 18.8	113 29.1	12.5	141 33.8	45.8	181 22.8	39.3	25 02.8	11.5	Markab	13 39.5	N15 16.1
20	231 21.3	128 28.2	12.4	156 34.4	46.0	196 25.0	39.4	40 05.2	11.5	Menkar	314 16.6	N 4 08.1
21	246 23.8	143 27.3 . .	12.2	171 35.0 . .	46.2	211 27.1 . .	39.5	55 07.5 . .	11.6	Menkent	148 09.1	S36 25.8
22	261 26.2	158 26.5	12.0	186 35.6	46.4	226 29.2	39.6	70 09.9	11.6	Miaplacidus	221 40.9	S69 46.1
23	276 28.7	173 25.6	11.8	201 36.2	46.6	241 31.4	39.7	85 12.2	11.7			
14 00	291 31.1	188 24.7	N23 11.7	216 36.8	N22 46.8	256 33.5	N12 39.8	100 14.6	S 2 11.8	Mirfak	308 42.6	N49 53.9
01	306 33.6	203 23.9	11.5	231 37.4	47.1	271 35.6	39.9	115 16.9	11.8	Nunki	75 59.6	S26 16.8
02	321 36.1	218 23.0	11.3	246 38.0	47.3	286 37.8	40.0	130 19.3	11.9	Peacock	53 20.7	S56 41.6
03	336 38.5	233 22.1 . .	11.1	261 38.6 . .	47.5	301 39.9 . .	40.1	145 21.6 . .	11.9	Pollux	243 29.7	N27 59.8
04	351 41.0	248 21.3	10.9	276 39.2	47.7	316 42.0	40.2	160 24.0	12.0	Procyon	245 01.5	N 5 11.7
05	6 43.5	263 20.4	10.7	291 39.8	47.9	331 44.1	40.4	175 26.3	12.0			
06	21 45.9	278 19.5	N23 10.6	306 40.4	N22 48.1	346 46.3	N12 40.5	190 28.7	S 2 12.1	Rasalhague	96 07.4	N12 33.2
07	36 48.4	293 18.7	10.4	321 41.0	48.3	1 48.4	40.6	205 31.1	12.2	Regulus	207 45.2	N11 54.6
T 08	51 50.9	308 17.8	10.2	336 41.6	48.5	16 50.5	40.7	220 33.4	12.2	Rigel	281 13.6	S 8 11.3
H 09	66 53.3	323 16.9 . .	10.0	351 42.2 . .	48.7	31 52.7 . .	40.8	235 35.8 . .	12.3	Rigil Kent.	139 53.4	S60 53.2
U 10	81 55.8	338 16.1	09.8	6 42.8	48.9	46 54.8	40.9	250 38.1	12.3	Sabik	102 13.8	S15 44.3
R 11	96 58.3	353 15.2	09.6	21 43.4	49.1	61 56.9	41.0	265 40.5	12.4			
S 12	112 00.7	8 14.3	N23 09.4	36 44.0	N22 49.3	76 59.1	N12 41.1	280 42.8	S 2 12.4	Schedar	349 42.0	N56 35.9
D 13	127 03.2	23 13.5	09.2	51 44.6	49.5	92 01.2	41.2	295 45.2	12.5	Shaula	96 23.4	S37 06.7
A 14	142 05.6	38 12.6	09.0	66 45.2	49.7	107 03.3	41.3	310 47.5	12.6	Sirius	258 35.3	S16 43.9
Y 15	157 08.1	53 11.7 . .	08.8	81 45.8 . .	50.0	122 05.5 . .	41.4	325 49.9 . .	12.6	Spica	158 32.7	S11 13.4
16	172 10.6	68 10.9	08.6	96 46.4	50.2	137 07.6	41.5	340 52.2	12.7	Suhail	222 53.9	S43 29.0
17	187 13.0	83 10.0	08.4	111 47.0	50.4	152 09.7	41.6	355 54.6	12.7			
18	202 15.5	98 09.1	N23 08.2	126 47.6	N22 50.6	167 11.9	N12 41.7	10 56.9	S 2 12.8	Vega	80 39.5	N38 47.8
19	217 18.0	113 08.3	08.0	141 48.2	50.8	182 14.0	41.8	25 59.3	12.9	Zuben'ubi	137 06.8	S16 05.5
20	232 20.4	128 07.4	07.8	156 48.8	51.0	197 16.1	41.9	41 01.6	12.9		SHA	Mer. Pass.
21	247 22.9	143 06.5 . .	07.6	171 49.4 . .	51.2	212 18.3 . .	42.0	56 04.0 . .	13.0		° ′	h m
22	262 25.4	158 05.7	07.4	186 50.0	51.4	227 20.4	42.1	71 06.3	13.0	Venus	258 13.6	11 26
23	277 27.8	173 04.8	07.2	201 50.6	51.6	242 22.5	42.2	86 08.7	13.1	Mars	285 50.4	9 34
	h m									Jupiter	325 10.4	6 56
Mer. Pass.	4 37.1	v −0.9	d 0.2	v 0.6	d 0.2	v 2.1	d 0.1	v 2.4	d 0.1	Saturn	168 46.1	17 20

UT	SUN			MOON					
	GHA		Dec	GHA		v	Dec		d	HP
d h	°	′	° ′	°	′	′	°	′	′	′
12 00	178	36.7	N22 02.6	43	19.2	5.9	S23	01.6	2.4	58.5
01	193	36.6	02.2	57	44.1	5.9	23	04.0	2.3	58.5
02	208	36.5	01.9	72	09.0	5.8	23	06.3	2.2	58.5
03	223	36.4	. . 01.5	86	33.8	5.9	23	08.5	2.0	58.5
04	238	36.4	01.2	100	58.7	5.9	23	10.5	1.8	58.5
05	253	36.3	00.9	115	23.6	5.9	23	12.3	1.7	58.4
06	268	36.2	N22 00.5	129	48.5	5.9	S23	14.0	1.6	58.4
07	283	36.1	22 00.2	144	13.4	5.8	23	15.6	1.4	58.4
08	298	36.0	21 59.8	158	38.2	5.9	23	17.0	1.2	58.4
09	313	36.0	. . 59.5	173	03.1	5.9	23	18.2	1.1	58.4
10	328	35.9	59.1	187	28.0	5.9	23	19.3	1.0	58.4
11	343	35.8	58.8	201	52.9	6.0	23	20.3	0.8	58.3
12	358	35.7	N21 58.4	216	17.9	5.9	S23	21.1	0.7	58.3
13	13	35.7	58.1	230	42.8	5.9	23	21.8	0.5	58.3
14	28	35.6	57.7	245	07.7	6.0	23	22.3	0.3	58.3
15	43	35.5	. . 57.4	259	32.7	6.0	23	22.6	0.2	58.3
16	58	35.4	57.1	273	57.7	6.0	23	22.8	0.1	58.3
17	73	35.3	56.7	288	22.7	6.0	23	22.9	0.1	58.2
18	88	35.3	N21 56.4	302	47.7	6.0	S23	22.8	0.2	58.2
19	103	35.2	56.0	317	12.7	6.1	23	22.6	0.4	58.2
20	118	35.1	55.6	331	37.8	6.1	23	22.2	0.5	58.2
21	133	35.0	. . 55.3	346	02.9	6.1	23	21.7	0.7	58.2
22	148	35.0	54.9	0	28.0	6.2	23	21.0	0.8	58.2
23	163	34.9	54.6	14	53.2	6.1	23	20.2	1.0	58.1
13 00	178	34.8	N21 54.2	29	18.3	6.2	S23	19.2	1.1	58.1
01	193	34.7	53.9	43	43.5	6.3	23	18.1	1.3	58.1
02	208	34.7	53.5	58	08.8	6.2	23	16.8	1.4	58.1
03	223	34.6	. . 53.2	72	34.0	6.4	23	15.4	1.6	58.1
04	238	34.5	52.8	86	59.4	6.3	23	13.8	1.7	58.0
05	253	34.4	52.5	101	24.7	6.4	23	12.1	1.8	58.0
06	268	34.4	N21 52.1	115	50.1	6.4	S23	10.3	2.0	58.0
07	283	34.3	51.7	130	15.5	6.5	23	08.3	2.1	58.0
08	298	34.2	51.4	144	41.0	6.5	23	06.2	2.3	58.0
09	313	34.1	. . 51.0	159	06.5	6.6	23	03.9	2.4	57.9
10	328	34.1	50.7	173	32.1	6.6	23	01.5	2.5	57.9
11	343	34.0	50.3	187	57.7	6.6	22	59.0	2.7	57.9
12	358	33.9	N21 49.9	202	23.3	6.7	S22	56.3	2.9	57.9
13	13	33.8	49.6	216	49.0	6.8	22	53.4	2.9	57.9
14	28	33.8	49.2	231	14.8	6.8	22	50.5	3.1	57.8
15	43	33.7	. . 48.8	245	40.6	6.8	22	47.4	3.3	57.8
16	58	33.6	48.5	260	06.4	6.9	22	44.1	3.4	57.8
17	73	33.6	48.1	274	32.3	7.0	22	40.7	3.5	57.8
18	88	33.5	N21 47.8	288	58.3	7.0	S22	37.2	3.6	57.8
19	103	33.4	47.4	303	24.3	7.1	22	33.6	3.8	57.7
20	118	33.3	47.0	317	50.4	7.1	22	29.8	3.9	57.7
21	133	33.3	. . 46.7	332	16.5	7.2	22	25.9	4.1	57.7
22	148	33.2	46.3	346	42.7	7.3	22	21.8	4.2	57.7
23	163	33.1	45.9	1	09.0	7.3	22	17.6	4.3	57.6
14 00	178	33.0	N21 45.5	15	35.3	7.4	S22	13.3	4.4	57.6
01	193	33.0	45.2	30	01.7	7.4	22	08.9	4.6	57.6
02	208	32.9	44.8	44	28.1	7.6	22	04.3	4.7	57.6
03	223	32.8	. . 44.4	58	54.7	7.5	21	59.6	4.8	57.6
04	238	32.8	44.1	73	21.2	7.7	21	54.8	5.0	57.5
05	253	32.7	43.7	87	47.9	7.7	21	49.8	5.0	57.5
06	268	32.6	N21 43.3	102	14.6	7.8	S21	44.8	5.2	57.5
07	283	32.6	42.9	116	41.4	7.8	21	39.6	5.3	57.5
08	298	32.5	42.6	131	08.2	8.0	21	34.3	5.5	57.5
09	313	32.4	. . 42.2	145	35.2	8.0	21	28.8	5.6	57.4
10	328	32.4	41.8	160	02.2	8.0	21	23.2	5.6	57.4
11	343	32.3	41.4	174	29.2	8.2	21	17.6	5.8	57.4
12	358	32.2	N21 41.1	188	56.4	8.2	S21	11.8	6.0	57.4
13	13	32.1	40.7	203	23.6	8.3	21	05.8	6.0	57.3
14	28	32.1	40.3	217	50.9	8.3	20	59.8	6.1	57.3
15	43	32.0	. . 39.9	232	18.2	8.5	20	53.7	6.3	57.3
16	58	31.9	39.5	246	45.7	8.5	20	47.4	6.4	57.3
17	73	31.9	39.2	261	13.2	8.6	20	41.0	6.5	57.2
18	88	31.8	N21 38.8	275	40.8	8.7	S20	34.5	6.6	57.2
19	103	31.7	38.4	290	08.5	8.7	20	27.9	6.7	57.2
20	118	31.7	38.0	304	36.2	8.9	20	21.2	6.8	57.2
21	133	31.6	. . 37.6	319	04.1	8.9	20	14.4	6.9	57.2
22	148	31.5	37.3	333	32.0	8.9	20	07.5	7.0	57.1
23	163	31.5	36.9	347	59.9	9.1	S20	00.5	7.2	57.1
	SD	15.8	d 0.4	SD		15.9		15.8		15.6

TUESDAY

WEDNESDAY

THURSDAY

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 12	Moonrise 13	Moonrise 14	Moonrise 15
°	h m	h m	h m	h m	h m	h m	h m
N 72							23 12
N 70							22 23
68						22 10	21 52
66	////	////	01 25	21 06	21 27	21 30	21 29
64	////	////	02 09	20 06	20 44	21 02	21 11
62	////	00 26	02 37	19 32	20 16	20 41	20 55
60	////	01 37	02 59	19 07	19 53	20 23	20 43
N 58	////	02 10	03 17	18 47	19 35	20 09	20 32
56	00 24	02 34	03 31	18 31	19 20	19 56	20 22
54	01 29	02 53	03 44	18 17	19 07	19 45	20 13
52	02 00	03 09	03 55	18 05	18 56	19 35	20 06
50	02 22	03 22	04 05	17 54	18 46	19 27	19 59
45	03 02	03 49	04 25	17 31	18 24	19 08	19 44
N 40	03 30	04 10	04 42	17 13	18 07	18 53	19 32
35	03 51	04 27	04 56	16 58	17 52	18 40	19 21
30	04 08	04 41	05 08	16 44	17 40	18 29	19 12
20	04 35	05 04	05 28	16 22	17 18	18 10	18 56
N 10	04 56	05 23	05 46	16 02	16 59	17 53	18 42
0	05 14	05 40	06 02	15 44	16 42	17 37	18 29
S 10	05 30	05 56	06 18	15 26	16 24	17 21	18 16
20	05 45	06 12	06 35	15 07	16 05	17 04	18 02
30	06 00	06 29	06 55	14 44	15 44	16 45	17 46
35	06 07	06 39	07 06	14 31	15 31	16 33	17 36
40	06 16	06 49	07 19	14 16	15 16	16 20	17 25
45	06 25	07 02	07 35	13 58	14 59	16 05	17 13
S 50	06 36	07 16	07 54	13 36	14 37	15 46	16 57
52	06 40	07 23	08 03	13 25	14 27	15 37	16 50
54	06 45	07 30	08 12	13 13	14 15	15 26	16 42
56	06 51	07 38	08 24	12 59	14 02	15 15	16 33
58	06 56	07 47	08 37	12 43	13 46	15 02	16 22
S 60	07 03	07 58	08 52	12 24	13 28	14 46	16 10

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 12	Moonset 13	Moonset 14	Moonset 15
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70							
68							01 41
66	22 43	////	////	22 51	24 30	00 30	02 20
64	22 01	////	////	23 51	25 12	01 12	02 47
62	21 33	23 34	////	24 25	00 25	01 40	03 08
60	21 11	22 32	////	24 50	00 50	02 02	03 25
N 58	20 54	21 59	////	00 14	01 10	02 20	03 39
56	20 39	21 36	23 37	00 30	01 26	02 35	03 51
54	20 27	21 17	22 40	00 44	01 40	02 48	04 02
52	20 16	21 02	22 10	00 56	01 52	02 59	04 11
50	20 06	20 48	21 48	01 06	02 03	03 09	04 19
45	19 46	20 22	21 09	01 28	02 26	03 30	04 37
N 40	19 29	20 01	20 41	01 46	02 44	03 46	04 51
35	19 15	19 44	20 20	02 01	02 59	04 00	05 04
30	19 03	19 30	20 03	02 14	03 12	04 13	05 14
20	18 43	19 07	19 36	02 36	03 34	04 34	05 32
N 10	18 26	18 48	19 15	02 56	03 54	04 52	05 48
0	18 09	18 32	18 58	03 14	04 12	05 09	06 02
S 10	17 53	18 16	18 42	03 32	04 30	05 25	06 17
20	17 36	18 00	18 27	03 51	04 49	05 43	06 32
30	17 17	17 43	18 12	04 13	05 11	06 04	06 50
35	17 05	17 33	18 04	04 26	05 24	06 16	07 00
40	16 52	17 22	17 56	04 41	05 39	06 29	07 12
45	16 37	17 10	17 47	04 59	05 57	06 46	07 25
S 50	16 18	16 56	17 36	05 21	06 19	07 05	07 42
52	16 09	16 49	17 32	05 32	06 29	07 15	07 50
54	15 59	16 42	17 27	05 44	06 41	07 25	07 58
56	15 48	16 33	17 21	05 57	06 55	07 37	08 08
58	15 35	16 24	17 16	06 13	07 10	07 51	08 19
S 60	15 20	16 14	17 09	06 33	07 29	08 07	08 31

Day	SUN Eqn. of Time 00^h	SUN Eqn. of Time 12^h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
12	05 33	05 37	12 06	21 58	09 29	11	91
13	05 41	05 44	12 06	22 55	10 27	12	96
14	05 48	05 51	12 06	23 50	11 23	13	99

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.3		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
15 00	292 30.3	188 03.9	N23 07.0	216 51.2	N22 51.8	257 24.7	N12 42.3	101 11.0	S 2 13.1
01	307 32.8	203 03.1	06.8	231 51.8	52.0	272 26.8	42.4	116 13.4	13.2
02	322 35.2	218 02.2	06.6	246 52.4	52.2	287 28.9	42.5	131 15.7	13.3
03	337 37.7	233 01.4	06.4	261 53.0	52.4	302 31.1	42.6	146 18.1	13.3
04	352 40.1	248 00.5	06.2	276 53.6	52.6	317 33.2	42.7	161 20.4	13.4
05	7 42.6	262 59.6	06.0	291 54.3	52.8	332 35.3	42.8	176 22.8	13.4
06	22 45.1	277 58.8	N23 05.8	306 54.9	N22 53.0	347 37.5	N12 42.9	191 25.1	S 2 13.5
07	37 47.5	292 57.9	05.5	321 55.5	53.2	2 39.6	43.0	206 27.5	13.6
08	52 50.0	307 57.0	05.3	336 56.1	53.4	17 41.7	43.1	221 29.8	13.6
F 09	67 52.5	322 56.2	05.1	351 56.7	53.6	32 43.9	43.2	236 32.2	13.7
R 10	82 54.9	337 55.3	04.9	6 57.3	53.8	47 46.0	43.3	251 34.5	13.7
I 11	97 57.4	352 54.5	04.7	21 57.9	54.0	62 48.2	43.4	266 36.9	13.8
D 12	112 59.9	7 53.6	N23 04.4	36 58.5	N22 54.2	77 50.3	N12 43.5	281 39.2	S 2 13.9
A 13	128 02.3	22 52.7	04.2	51 59.1	54.4	92 52.4	43.6	296 41.6	13.9
Y 14	143 04.8	37 51.9	04.0	66 59.7	54.6	107 54.6	43.7	311 43.9	14.0
15	158 07.2	52 51.0	03.8	82 00.3	54.7	122 56.7	43.8	326 46.3	14.0
16	173 09.7	67 50.1	03.5	97 00.9	54.9	137 58.8	44.0	341 48.6	14.1
17	188 12.2	82 49.3	03.3	112 01.5	55.1	153 01.0	44.1	356 50.9	14.2
18	203 14.6	97 48.4	N23 03.1	127 02.1	N22 55.3	168 03.1	N12 44.2	11 53.3	S 2 14.2
19	218 17.1	112 47.6	02.9	142 02.7	55.5	183 05.3	44.3	26 55.6	14.3
20	233 19.6	127 46.7	02.6	157 03.3	55.7	198 07.4	44.4	41 58.0	14.3
21	248 22.0	142 45.8	02.4	172 03.9	55.9	213 09.5	44.5	57 00.3	14.4
22	263 24.5	157 45.0	02.2	187 04.5	56.1	228 11.7	44.6	72 02.7	14.5
23	278 27.0	172 44.1	01.9	202 05.1	56.3	243 13.8	44.7	87 05.0	14.5
16 00	293 29.4	187 43.3	N23 01.7	217 05.7	N22 56.5	258 16.0	N12 44.8	102 07.4	S 2 14.6
01	308 31.9	202 42.4	01.5	232 06.3	56.7	273 18.1	44.9	117 09.7	14.6
02	323 34.4	217 41.5	01.2	247 06.9	56.9	288 20.2	45.0	132 12.1	14.7
03	338 36.8	232 40.7	01.0	262 07.5	57.1	303 22.4	45.1	147 14.4	14.8
04	353 39.3	247 39.8	00.7	277 08.1	57.3	318 24.5	45.2	162 16.8	14.8
05	8 41.7	262 39.0	00.5	292 08.7	57.4	333 26.7	45.3	177 19.1	14.9
06	23 44.2	277 38.1	N23 00.3	307 09.3	N22 57.6	348 28.8	N12 45.4	192 21.5	S 2 14.9
07	38 46.7	292 37.2	23 00.0	322 09.9	57.8	3 31.0	45.5	207 23.8	15.0
S 08	53 49.1	307 36.4	22 59.8	337 10.5	58.0	18 33.1	45.6	222 26.1	15.1
A 09	68 51.6	322 35.5	59.5	352 11.1	58.2	33 35.2	45.7	237 28.5	15.1
T 10	83 54.1	337 34.7	59.3	7 11.7	58.4	48 37.4	45.8	252 30.8	15.2
U 11	98 56.5	352 33.8	59.0	22 12.3	58.6	63 39.5	45.9	267 33.2	15.2
R 12	113 59.0	7 32.9	N22 58.8	37 12.9	N22 58.8	78 41.7	N12 46.0	282 35.5	S 2 15.3
D 13	129 01.5	22 32.1	58.5	52 13.5	59.0	93 43.8	46.1	297 37.9	15.4
A 14	144 03.9	37 31.2	58.3	67 14.1	59.1	108 46.0	46.2	312 40.2	15.4
Y 15	159 06.4	52 30.4	58.0	82 14.7	59.3	123 48.1	46.3	327 42.6	15.5
16	174 08.9	67 29.5	57.8	97 15.3	59.5	138 50.2	46.4	342 44.9	15.5
17	189 11.3	82 28.7	57.5	112 15.9	59.7	153 52.4	46.5	357 47.3	15.6
18	204 13.8	97 27.8	N22 57.3	127 16.5	N22 59.9	168 54.5	N12 46.6	12 49.6	S 2 15.7
19	219 16.2	112 26.9	57.0	142 17.1	23 00.1	183 56.7	46.7	27 51.9	15.7
20	234 18.7	127 26.1	56.8	157 17.8	00.3	198 58.8	46.8	42 54.3	15.8
21	249 21.2	142 25.2	56.5	172 18.4	00.4	214 01.0	46.9	57 56.6	15.9
22	264 23.6	157 24.4	56.2	187 19.0	00.6	229 03.1	46.9	72 59.0	15.9
23	279 26.1	172 23.5	56.0	202 19.6	00.8	244 05.3	47.0	88 01.3	16.0
17 00	294 28.6	187 22.7	N22 55.7	217 20.2	N23 01.0	259 07.4	N12 47.1	103 03.7	S 2 16.0
01	309 31.0	202 21.8	55.4	232 20.8	01.2	274 09.5	47.2	118 06.0	16.1
02	324 33.5	217 20.9	55.2	247 21.4	01.4	289 11.7	47.3	133 08.3	16.2
03	339 36.0	232 20.1	54.9	262 22.0	01.5	304 13.8	47.4	148 10.7	16.2
04	354 38.4	247 19.2	54.6	277 22.6	01.7	319 16.0	47.5	163 13.0	16.3
05	9 40.9	262 18.4	54.4	292 23.2	01.9	334 18.1	47.6	178 15.4	16.3
06	24 43.4	277 17.5	N22 54.1	307 23.8	N23 02.1	349 20.3	N12 47.7	193 17.7	S 2 16.4
07	39 45.8	292 16.7	53.8	322 24.4	02.3	4 22.4	47.8	208 20.1	16.5
08	54 48.3	307 15.8	53.6	337 25.0	02.4	19 24.6	47.9	223 22.4	16.5
S 09	69 50.7	322 15.0	53.3	352 25.6	02.6	34 26.7	48.0	238 24.7	16.6
U 10	84 53.2	337 14.1	53.0	7 26.2	02.8	49 28.9	48.1	253 27.1	16.7
N 11	99 55.7	352 13.2	52.7	22 26.8	03.0	64 31.0	48.2	268 29.4	16.7
D 12	114 58.1	7 12.4	N22 52.5	37 27.4	N23 03.2	79 33.2	N12 48.3	283 31.8	S 2 16.8
A 13	130 00.6	22 11.5	52.2	52 28.0	03.3	94 35.3	48.4	298 34.1	16.8
Y 14	145 03.1	37 10.7	51.9	67 28.6	03.5	109 37.5	48.5	313 36.4	16.9
15	160 05.5	52 09.8	51.6	82 29.2	03.7	124 39.6	48.6	328 38.8	17.0
16	175 08.0	67 09.0	51.3	97 29.8	03.9	139 41.8	48.7	343 41.1	17.0
17	190 10.5	82 08.1	51.0	112 30.4	04.1	154 43.9	48.8	358 43.5	17.1
18	205 12.9	97 07.3	N22 50.8	127 31.0	N23 04.2	169 46.1	N12 48.9	13 45.8	S 2 17.1
19	220 15.4	112 06.4	50.5	142 31.6	04.4	184 48.2	49.0	28 48.2	17.2
20	235 17.8	127 05.6	50.2	157 32.2	04.6	199 50.4	49.1	43 50.5	17.3
21	250 20.3	142 04.7	49.9	172 32.8	04.8	214 52.5	49.2	58 52.8	17.3
22	265 22.8	157 03.9	49.6	187 33.4	04.9	229 54.7	49.3	73 55.2	17.4
23	280 25.2	172 03.0	49.3	202 34.1	05.1	244 56.8	49.4	88 57.5	17.5
	h m								
Mer. Pass.	4 25.3	*v* −0.9	*d* 0.2	*v* 0.6	*d* 0.2	*v* 2.1	*d* 0.1	*v* 2.3	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.5	S40 15.2
Achernar	335 27.7	S57 10.3
Acrux	173 11.1	S63 10.2
Adhara	255 14.0	S28 59.3
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.9	N55 54.0
Alkaid	152 59.9	N49 15.5
Al Na'ir	27 45.0	S46 54.0
Alnilam	275 48.0	S 1 11.7
Alphard	217 57.7	S 8 42.6
Alphecca	126 11.9	N26 40.7
Alpheratz	357 44.8	N29 09.3
Altair	62 09.2	N 8 54.1
Ankaa	353 16.9	S42 14.2
Antares	112 27.6	S26 27.5
Arcturus	145 56.9	N19 07.4
Atria	107 30.2	S69 03.0
Avior	234 19.2	S59 32.9
Bellatrix	278 33.7	N 6 21.6
Betelgeuse	271 03.1	N 7 24.5
Canopus	263 57.3	S52 42.1
Capella	280 36.8	N46 00.4
Deneb	49 32.0	N45 19.4
Denebola	182 35.2	N14 30.5
Diphda	348 57.1	S17 55.1
Dubhe	193 53.7	N61 41.5
Elnath	278 14.6	N28 36.9
Eltanin	90 46.3	N51 29.4
Enif	33 48.2	N 9 55.8
Fomalhaut	15 25.2	S29 33.4
Gacrux	172 02.6	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.8	S60 26.0
Hamal	328 02.3	N23 31.0
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 19.4	N74 06.7
Markab	13 39.5	N15 16.2
Menkar	314 16.6	N 4 08.2
Menkent	148 09.1	S36 25.8
Miaplacidus	221 40.9	S69 46.1
Mirfak	308 42.6	N49 53.9
Nunki	75 59.6	S26 16.8
Peacock	53 20.7	S56 41.6
Pollux	243 29.7	N27 59.8
Procyon	245 01.5	N 5 11.7
Rasalhague	96 07.4	N12 33.2
Regulus	207 45.2	N11 54.6
Rigel	281 13.6	S 8 11.3
Rigil Kent.	139 53.4	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.0	N56 35.9
Shaula	96 23.4	S37 06.7
Sirius	258 35.2	S16 43.9
Spica	158 32.7	S11 13.4
Suhail	222 53.9	S43 28.9
Vega	80 39.5	N38 47.8
Zuben'ubi	137 06.8	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	254 13.8	11 30
Mars	283 36.3	9 31
Jupiter	324 46.5	6 46
Saturn	168 38.0	17 09

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
15 00	178 31.4	N21 36.5	2 28.0	9.2	S19 53.3	7.2	57.1
01	193 31.3	36.1	16 56.2	9.2	19 46.1	7.4	57.1
02	208 31.3	35.7	31 24.4	9.3	19 38.7	7.4	57.0
03	223 31.2	. . 35.3	45 52.7	9.4	19 31.3	7.5	57.0
04	238 31.2	34.9	60 21.1	9.5	19 23.8	7.7	57.0
05	253 31.1	34.6	74 49.6	9.5	19 16.1	7.7	57.0
06	268 31.0	N21 34.2	89 18.1	9.6	S19 08.4	7.9	56.9
07	283 31.0	33.8	103 46.7	9.8	19 00.5	7.9	56.9
08	298 30.9	33.4	118 15.5	9.8	18 52.6	8.0	56.9
F 09	313 30.8	. . 33.0	132 44.3	9.8	18 44.6	8.1	56.9
R 10	328 30.8	32.6	147 13.1	10.0	18 36.5	8.2	56.8
I 11	343 30.7	32.2	161 42.1	10.1	18 28.3	8.3	56.8
D 12	358 30.6	N21 31.8	176 11.2	10.1	S18 20.0	8.4	56.8
A 13	13 30.6	31.4	190 40.3	10.2	18 11.6	8.5	56.8
Y 14	28 30.5	31.0	205 09.5	10.3	18 03.1	8.6	56.7
15	43 30.5	. . 30.6	219 38.8	10.4	17 54.5	8.6	56.7
16	58 30.4	30.2	234 08.2	10.4	17 45.9	8.8	56.7
17	73 30.3	29.8	248 37.6	10.6	17 37.1	8.8	56.7
18	88 30.3	N21 29.5	263 07.2	10.6	S17 28.3	8.9	56.6
19	103 30.2	29.1	277 36.8	10.7	17 19.4	9.0	56.6
20	118 30.1	28.7	292 06.5	10.8	17 10.4	9.0	56.6
21	133 30.1	. . 28.3	306 36.3	10.8	17 01.4	9.2	56.6
22	148 30.0	27.9	321 06.1	11.0	16 52.2	9.2	56.5
23	163 30.0	27.5	335 36.1	11.0	16 43.0	9.3	56.5
16 00	178 29.9	N21 27.1	350 06.1	11.1	S16 33.7	9.3	56.5
01	193 29.8	26.7	4 36.2	11.2	16 24.4	9.5	56.5
02	208 29.8	26.3	19 06.4	11.3	16 14.9	9.5	56.5
03	223 29.7	. . 25.9	33 36.7	11.3	16 05.4	9.6	56.4
04	238 29.7	25.5	48 07.0	11.5	15 55.8	9.6	56.4
05	253 29.6	25.0	62 37.5	11.5	15 46.2	9.8	56.4
06	268 29.5	N21 24.6	77 08.0	11.6	S15 36.4	9.8	56.4
07	283 29.5	24.2	91 38.6	11.7	15 26.6	9.8	56.3
S 08	298 29.4	23.8	106 09.3	11.7	15 16.8	9.9	56.3
A 09	313 29.4	. . 23.4	120 40.0	11.8	15 06.9	10.0	56.3
T 10	328 29.3	23.0	135 10.8	11.9	14 56.9	10.1	56.3
U 11	343 29.2	22.6	149 41.7	12.0	14 46.8	10.1	56.2
R 12	358 29.2	N21 22.2	164 12.7	12.1	S14 36.7	10.2	56.2
D 13	13 29.1	21.8	178 43.8	12.1	14 26.5	10.2	56.2
A 14	28 29.1	21.4	193 14.9	12.2	14 16.3	10.3	56.2
Y 15	43 29.0	. . 21.0	207 46.1	12.3	14 06.0	10.3	56.1
16	58 29.0	20.6	222 17.4	12.4	13 55.7	10.4	56.1
17	73 28.9	20.2	236 48.8	12.4	13 45.3	10.5	56.1
18	88 28.8	N21 19.7	251 20.2	12.5	S13 34.8	10.5	56.1
19	103 28.8	19.3	265 51.7	12.6	13 24.3	10.6	56.0
20	118 28.7	18.9	280 23.3	12.7	13 13.7	10.6	56.0
21	133 28.7	. . 18.5	294 55.0	12.7	13 03.1	10.7	56.0
22	148 28.6	18.1	309 26.7	12.8	12 52.4	10.7	56.0
23	163 28.6	17.7	323 58.5	12.8	12 41.7	10.8	55.9
17 00	178 28.5	N21 17.3	338 30.3	13.0	S12 30.9	10.8	55.9
01	193 28.5	16.9	353 02.3	13.0	12 20.1	10.9	55.9
02	208 28.4	16.4	7 34.3	13.1	12 09.2	10.9	55.9
03	223 28.3	. . 16.0	22 06.4	13.1	11 58.3	10.9	55.8
04	238 28.3	15.6	36 38.5	13.2	11 47.4	11.0	55.8
05	253 28.2	15.2	51 10.7	13.3	11 36.4	11.1	55.8
06	268 28.2	N21 14.8	65 43.0	13.4	S11 25.3	11.0	55.8
07	283 28.1	14.3	80 15.4	13.4	11 14.3	11.2	55.8
08	298 28.1	13.9	94 47.8	13.4	11 03.1	11.1	55.7
S 09	313 28.0	. . 13.5	109 20.2	13.6	10 52.0	11.2	55.7
U 10	328 28.0	13.1	123 52.8	13.6	10 40.8	11.2	55.7
N 11	343 27.9	12.7	138 25.4	13.7	10 29.6	11.3	55.7
D 12	358 27.9	N21 12.2	152 58.1	13.7	S10 18.3	11.3	55.6
A 13	13 27.8	11.8	167 30.8	13.8	10 07.0	11.4	55.6
Y 14	28 27.8	11.4	182 03.6	13.8	9 55.6	11.3	55.6
15	43 27.7	. . 11.0	196 36.4	13.9	9 44.3	11.4	55.6
16	58 27.7	10.5	211 09.3	14.0	9 32.9	11.5	55.5
17	73 27.6	10.1	225 42.3	14.0	9 21.4	11.4	55.5
18	88 27.6	N21 09.7	240 15.3	14.1	S 9 10.0	11.5	55.5
19	103 27.5	09.3	254 48.4	14.1	8 58.5	11.6	55.5
20	118 27.5	08.8	269 21.5	14.2	8 46.9	11.5	55.5
21	133 27.4	. . 08.4	283 54.7	14.3	8 35.4	11.6	55.4
22	148 27.4	08.0	298 28.0	14.3	8 23.8	11.6	55.4
23	163 27.3	07.5	313 01.3	14.3	S 8 12.2	11.6	55.4
	SD 15.8	d 0.4	SD	15.5		15.3	15.2

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 15	Moonrise 16	Moonrise 17	Moonrise 18
	h m	h m	h m	h m	h m	h m	h m
N 72				23 12	22 23	21 56	21 35
N 70				22 23	22 00	21 43	21 30
68				21 52	21 42	21 33	21 26
66	////	////	01 38	21 29	21 27	21 25	21 22
64	////	////	02 17	21 11	21 15	21 18	21 19
62	////	00 54	02 44	20 55	21 05	21 11	21 16
60	////	01 47	03 05	20 43	20 56	21 06	21 14
N 58	////	02 17	03 22	20 32	20 48	21 01	21 12
56	00 50	02 40	03 36	20 22	20 41	20 57	21 10
54	01 38	02 58	03 48	20 13	20 35	20 53	21 08
52	02 06	03 13	03 59	20 06	20 30	20 50	21 07
50	02 28	03 26	04 08	19 59	20 25	20 46	21 05
45	03 06	03 52	04 28	19 44	20 14	20 39	21 02
N 40	03 33	04 12	04 44	19 32	20 05	20 34	21 00
35	03 53	04 29	04 58	19 21	19 57	20 29	20 58
30	04 10	04 43	05 09	19 12	19 50	20 24	20 56
20	04 37	05 05	05 29	18 56	19 38	20 16	20 52
N 10	04 57	05 24	05 47	18 42	19 27	20 10	20 49
0	05 14	05 40	06 02	18 29	19 18	20 03	20 46
S 10	05 30	05 56	06 18	18 16	19 08	19 57	20 43
20	05 44	06 11	06 35	18 02	18 57	19 50	20 40
30	05 59	06 28	06 54	17 46	18 45	19 42	20 37
35	06 06	06 38	07 05	17 36	18 38	19 37	20 35
40	06 15	06 48	07 18	17 25	18 30	19 32	20 33
45	06 24	07 00	07 33	17 13	18 20	19 26	20 30
S 50	06 34	07 14	07 51	16 57	18 09	19 19	20 27
52	06 38	07 21	08 00	16 50	18 04	19 16	20 25
54	06 43	07 28	08 09	16 42	17 58	19 12	20 24
56	06 48	07 35	08 20	16 33	17 51	19 08	20 22
58	06 54	07 44	08 33	16 22	17 44	19 03	20 20
S 60	07 00	07 54	08 47	16 10	17 35	18 58	20 18

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 15	Moonset 16	Moonset 17	Moonset 18
	h m	h m	h m	h m	h m	h m	h m
N 72					02 28	04 56	06 56
N 70					03 15	05 18	07 07
68				01 41	03 45	05 34	07 15
66	22 30	////	////	02 20	04 07	05 47	07 22
64	21 53	////	////	02 47	04 24	05 58	07 27
62	21 26	23 12	////	03 08	04 39	06 07	07 32
60	21 06	22 23	////	03 25	04 51	06 15	07 37
N 58	20 49	21 53	////	03 39	05 01	06 22	07 40
56	20 35	21 31	23 17	03 51	05 10	06 28	07 44
54	20 23	21 13	22 32	04 02	05 18	06 33	07 47
52	20 13	20 58	22 04	04 11	05 25	06 38	07 49
50	20 03	20 45	21 43	04 19	05 32	06 43	07 52
45	19 43	20 19	21 06	04 37	05 45	06 52	07 57
N 40	19 28	19 59	20 39	04 51	05 56	07 00	08 02
35	19 14	19 43	20 18	05 04	06 06	07 07	08 05
30	19 02	19 29	20 02	05 14	06 14	07 13	08 09
20	18 43	19 07	19 35	05 32	06 29	07 23	08 14
N 10	18 26	18 48	19 15	05 48	06 41	07 32	08 19
0	18 10	18 32	18 58	06 02	06 53	07 40	08 24
S 10	17 54	18 16	18 42	06 17	07 04	07 48	08 29
20	17 37	18 01	18 28	06 32	07 16	07 57	08 34
30	17 18	17 44	18 13	06 50	07 30	08 06	08 39
35	17 07	17 35	18 06	07 00	07 38	08 12	08 42
40	16 54	17 24	17 58	07 12	07 47	08 18	08 46
45	16 40	17 12	17 49	07 25	07 58	08 26	08 50
S 50	16 21	16 58	17 39	07 42	08 11	08 34	08 55
52	16 13	16 52	17 35	07 50	08 17	08 38	08 57
54	16 03	16 45	17 30	07 58	08 23	08 43	08 59
56	15 52	16 37	17 25	08 08	08 30	08 48	09 02
58	15 40	16 28	17 19	08 19	08 39	08 53	09 05
S 60	15 25	16 19	17 13	08 31	08 48	08 59	09 08

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	%
15	05 54	05 57	12 06	24 41	12 16	14	100
16	06 00	06 03	12 06	00 41	13 05	15	98
17	06 06	06 08	12 06	01 29	13 52	16	95

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.4		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
18 00	295 27.7	187 02.2	N22 49.0	217 34.7	N23 05.3	259 59.0	N12 49.5	103 59.9	S 2 17.5
01	310 30.2	202 01.3	48.7	232 35.3	05.5	275 01.1	49.6	119 02.2	17.6
02	325 32.6	217 00.5	48.4	247 35.9	05.6	290 03.3	49.7	134 04.5	17.7
03	340 35.1	231 59.6	48.1	262 36.5	05.8	305 05.4	49.8	149 06.9	17.7
04	355 37.6	246 58.8	47.9	277 37.1	06.0	320 07.6	49.9	164 09.2	17.8
05	10 40.0	261 57.9	47.6	292 37.7	06.1	335 09.7	50.0	179 11.6	17.8
06	25 42.5	276 57.1	N22 47.3	307 38.3	N23 06.3	350 11.9	N12 50.1	194 13.9	S 2 17.9
07	40 45.0	291 56.2	47.0	322 38.9	06.5	5 14.0	50.2	209 16.2	18.0
08	55 47.4	306 55.4	46.7	337 39.5	06.7	20 16.2	50.3	224 18.6	18.0
M 09	70 49.9	321 54.5	46.4	352 40.1	06.8	35 18.3	50.3	239 20.9	18.1
O 10	85 52.3	336 53.7	46.1	7 40.7	07.0	50 20.5	50.4	254 23.2	18.2
N 11	100 54.8	351 52.8	45.7	22 41.3	07.2	65 22.6	50.5	269 25.6	18.2
D 12	115 57.3	6 52.0	N22 45.4	37 41.9	N23 07.3	80 24.8	N12 50.6	284 27.9	S 2 18.3
A 13	130 59.7	21 51.1	45.1	52 42.5	07.5	95 26.9	50.7	299 30.3	18.3
Y 14	146 02.2	36 50.3	44.8	67 43.1	07.7	110 29.1	50.8	314 32.6	18.4
15	161 04.7	51 49.4	44.5	82 43.7	07.9	125 31.3	50.9	329 34.9	18.5
16	176 07.1	66 48.6	44.2	97 44.3	08.0	140 33.4	51.0	344 37.3	18.5
17	191 09.6	81 47.7	43.9	112 44.9	08.2	155 35.6	51.1	359 39.6	18.6
18	206 12.1	96 46.9	N22 43.6	127 45.5	N23 08.4	170 37.7	N12 51.2	14 41.9	S 2 18.7
19	221 14.5	111 46.0	43.3	142 46.1	08.5	185 39.9	51.3	29 44.3	18.7
20	236 17.0	126 45.2	43.0	157 46.7	08.7	200 42.0	51.4	44 46.6	18.8
21	251 19.5	141 44.3	42.6	172 47.3	08.9	215 44.2	51.5	59 49.0	18.9
22	266 21.9	156 43.5	42.3	187 48.0	09.0	230 46.3	51.6	74 51.3	18.9
23	281 24.4	171 42.6	42.0	202 48.6	09.2	245 48.5	51.7	89 53.6	19.0
19 00	296 26.8	186 41.8	N22 41.7	217 49.2	N23 09.4	260 50.7	N12 51.8	104 56.0	S 2 19.0
01	311 29.3	201 40.9	41.4	232 49.8	09.5	275 52.8	51.9	119 58.3	19.1
02	326 31.8	216 40.1	41.0	247 50.4	09.7	290 55.0	52.0	135 00.6	19.2
03	341 34.2	231 39.2	40.7	262 51.0	09.9	305 57.1	52.1	150 03.0	19.2
04	356 36.7	246 38.4	40.4	277 51.6	10.0	320 59.3	52.1	165 05.3	19.3
05	11 39.2	261 37.5	40.1	292 52.2	10.2	336 01.4	52.2	180 07.7	19.4
06	26 41.6	276 36.7	N22 39.7	307 52.8	N23 10.3	351 03.6	N12 52.3	195 10.0	S 2 19.4
07	41 44.1	291 35.9	39.4	322 53.4	10.5	6 05.8	52.4	210 12.3	19.5
T 08	56 46.6	306 35.0	39.1	337 54.0	10.7	21 07.9	52.5	225 14.7	19.6
U 09	71 49.0	321 34.2	38.8	352 54.6	10.8	36 10.1	52.6	240 17.0	19.6
E 10	86 51.5	336 33.3	38.4	7 55.2	11.0	51 12.2	52.7	255 19.3	19.7
S 11	101 53.9	351 32.5	38.1	22 55.8	11.2	66 14.4	52.8	270 21.7	19.8
D 12	116 56.4	6 31.6	N22 37.8	37 56.4	N23 11.3	81 16.6	N12 52.9	285 24.0	S 2 19.8
A 13	131 58.9	21 30.8	37.4	52 57.0	11.5	96 18.7	53.0	300 26.3	19.9
Y 14	147 01.3	36 30.0	37.1	67 57.6	11.6	111 20.9	53.1	315 28.7	20.0
15	162 03.8	51 29.1	36.8	82 58.2	11.8	126 23.0	53.2	330 31.0	20.0
16	177 06.3	66 28.3	36.4	97 58.8	12.0	141 25.2	53.3	345 33.3	20.1
17	192 08.7	81 27.4	36.1	112 59.5	12.1	156 27.4	53.4	0 35.7	20.1
18	207 11.2	96 26.6	N22 35.7	128 00.1	N23 12.3	171 29.5	N12 53.4	15 38.0	S 2 20.2
19	222 13.7	111 25.7	35.4	143 00.7	12.4	186 31.7	53.5	30 40.3	20.3
20	237 16.1	126 24.9	35.0	158 01.3	12.6	201 33.8	53.6	45 42.7	20.3
21	252 18.6	141 24.1	34.7	173 01.9	12.8	216 36.0	53.7	60 45.0	20.4
22	267 21.1	156 23.2	34.4	188 02.5	12.9	231 38.2	53.8	75 47.3	20.5
23	282 23.5	171 22.4	34.0	203 03.1	13.1	246 40.3	53.9	90 49.7	20.5
20 00	297 26.0	186 21.5	N22 33.7	218 03.7	N23 13.2	261 42.5	N12 54.0	105 52.0	S 2 20.6
01	312 28.4	201 20.7	33.3	233 04.3	13.4	276 44.7	54.1	120 54.3	20.7
02	327 30.9	216 19.8	33.0	248 04.9	13.5	291 46.8	54.2	135 56.7	20.7
03	342 33.4	231 19.0	32.6	263 05.5	13.7	306 49.0	54.3	150 59.0	20.8
04	357 35.8	246 18.2	32.3	278 06.1	13.8	321 51.1	54.4	166 01.3	20.9
05	12 38.3	261 17.3	31.9	293 06.7	14.0	336 53.3	54.5	181 03.7	20.9
06	27 40.8	276 16.5	N22 31.6	308 07.3	N23 14.2	351 55.5	N12 54.6	196 06.0	S 2 21.0
W 07	42 43.2	291 15.7	31.2	323 07.9	14.3	6 57.6	54.6	211 08.3	21.1
E 08	57 45.7	306 14.8	30.8	338 08.5	14.5	21 59.8	54.7	226 10.7	21.1
D 09	72 48.2	321 14.0	30.5	353 09.2	14.6	37 02.0	54.8	241 13.0	21.2
N 10	87 50.6	336 13.1	30.1	8 09.8	14.8	52 04.1	54.9	256 15.3	21.3
E 11	102 53.1	351 12.3	29.8	23 10.4	14.9	67 06.3	55.0	271 17.7	21.3
S 12	117 55.5	6 11.5	N22 29.4	38 11.0	N23 15.1	82 08.5	N12 55.1	286 20.0	S 2 21.4
D 13	132 58.0	21 10.6	29.0	53 11.6	15.2	97 10.6	55.2	301 22.3	21.5
A 14	148 00.5	36 09.8	28.7	68 12.2	15.4	112 12.8	55.3	316 24.7	21.5
Y 15	163 02.9	51 08.9	28.3	83 12.8	15.5	127 15.0	55.4	331 27.0	21.6
16	178 05.4	66 08.1	28.0	98 13.4	15.7	142 17.1	55.5	346 29.3	21.7
17	193 07.9	81 07.3	27.6	113 14.0	15.8	157 19.3	55.6	1 31.7	21.7
18	208 10.3	96 06.4	N22 27.2	128 14.6	N23 16.0	172 21.5	N12 55.6	16 34.0	S 2 21.8
19	223 12.8	111 05.6	26.8	143 15.2	16.1	187 23.6	55.7	31 36.3	21.9
20	238 15.3	126 04.8	26.5	158 15.8	16.3	202 25.8	55.8	46 38.6	21.9
21	253 17.7	141 03.9	26.1	173 16.4	16.4	217 28.0	55.9	61 41.0	22.0
22	268 20.2	156 03.1	25.7	188 17.0	16.6	232 30.1	56.0	76 43.3	22.1
23	283 22.7	171 02.3	25.4	203 17.6	16.7	247 32.3	56.1	91 45.6	22.1
Mer. Pass.	h m 4 13.5	v −0.8	d 0.3	v 0.6	d 0.2	v 2.2	d 0.1	v 2.3	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.5	S40 15.2
Achernar	335 27.7	S57 10.3
Acrux	173 11.1	S63 10.2
Adhara	255 14.0	S28 59.3
Aldebaran	290 51.2	N16 31.9
Alioth	166 21.9	N55 54.0
Alkaid	152 59.9	N49 15.5
Al Na'ir	27 45.0	S46 54.0
Alnilam	275 48.0	S 1 11.7
Alphard	217 57.7	S 8 42.6
Alphecca	126 11.9	N26 40.7
Alpheratz	357 44.8	N29 09.3
Altair	62 09.2	N 8 54.1
Ankaa	353 16.8	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 56.9	N19 07.4
Atria	107 30.3	S69 03.0
Avior	234 19.3	S59 32.9
Bellatrix	278 33.7	N 6 21.6
Betelgeuse	271 03.0	N 7 24.5
Canopus	263 57.3	S52 42.1
Capella	280 36.8	N46 00.4
Deneb	49 32.0	N45 19.4
Denebola	182 35.2	N14 30.5
Diphda	348 57.1	S17 55.1
Dubhe	193 53.7	N61 41.4
Elnath	278 14.6	N28 36.9
Eltanin	90 46.3	N51 29.4
Enif	33 48.1	N 9 55.8
Fomalhaut	15 25.2	S29 33.4
Gacrux	172 02.6	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.8	S60 26.0
Hamal	328 02.3	N23 31.0
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 19.5	N74 06.7
Markab	13 39.5	N15 16.2
Menkar	314 16.6	N 4 08.2
Menkent	148 09.1	S36 25.8
Miaplacidus	221 40.9	S69 46.1
Mirfak	308 42.5	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.7	S56 41.6
Pollux	243 29.7	N27 59.8
Procyon	245 01.5	N 5 11.7
Rasalhague	96 07.4	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.6	S 8 11.3
Rigil Kent.	139 53.4	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 42.0	N56 35.9
Shaula	96 23.4	S37 06.7
Sirius	258 35.2	S16 43.9
Spica	158 32.7	S11 13.4
Suhail	222 53.9	S43 28.9
Vega	80 39.5	N38 47.8
Zuben'ubi	137 06.8	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	250 14.9	11 34
Mars	281 22.3	9 28
Jupiter	324 23.8	6 36
Saturn	168 29.1	16 58

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
18 00	178 27.3	N21 07.1	327 34.6	14.4	S 8 00.6	11.7	55.4
01	193 27.2	06.7	342 08.0	14.5	7 48.9	11.7	55.3
02	208 27.2	06.2	356 41.5	14.5	7 37.2	11.7	55.3
03	223 27.1	. . 05.8	11 15.0	14.6	7 25.5	11.7	55.3
04	238 27.1	05.4	25 48.6	14.6	7 13.8	11.7	55.3
05	253 27.0	05.0	40 22.2	14.6	7 02.1	11.8	55.3
06	268 27.0	N21 04.5	54 55.8	14.7	S 6 50.3	11.8	55.2
07	283 26.9	04.1	69 29.5	14.8	6 38.5	11.8	55.2
08	298 26.9	03.6	84 03.3	14.8	6 26.7	11.8	55.2
M 09	313 26.8	. . 03.2	98 37.1	14.8	6 14.9	11.9	55.2
O 10	328 26.8	02.8	113 10.9	14.9	6 03.1	11.8	55.2
N 11	343 26.7	02.3	127 44.8	14.9	5 51.3	11.9	55.1
D 12	358 26.7	N21 01.9	142 18.7	15.0	S 5 39.4	11.9	55.1
A 13	13 26.6	01.5	156 52.7	15.0	5 27.5	11.9	55.1
Y 14	28 26.6	01.0	171 26.7	15.1	5 15.6	11.9	55.1
15	43 26.5	. . 00.6	186 00.8	15.1	5 03.7	11.9	55.1
16	58 26.5	21 00.1	200 34.9	15.1	4 51.8	11.9	55.0
17	73 26.4	20 59.7	215 09.0	15.2	4 39.9	11.9	55.0
18	88 26.4	N20 59.3	229 43.2	15.2	S 4 28.0	12.0	55.0
19	103 26.3	58.8	244 17.4	15.2	4 16.0	11.9	55.0
20	118 26.3	58.4	258 51.6	15.3	4 04.1	11.9	55.0
21	133 26.3	. . 57.9	273 25.9	15.3	3 52.2	12.0	55.0
22	148 26.2	57.5	288 00.2	15.3	3 40.2	12.0	54.9
23	163 26.2	57.0	302 34.5	15.4	3 28.2	11.9	54.9
19 00	178 26.1	N20 56.6	317 08.9	15.4	S 3 16.3	12.0	54.9
01	193 26.1	56.2	331 43.3	15.5	3 04.3	12.0	54.9
02	208 26.0	55.7	346 17.8	15.4	2 52.3	12.0	54.9
03	223 26.0	. . 55.3	0 52.2	15.5	2 40.3	12.0	54.8
04	238 25.9	54.8	15 26.7	15.5	2 28.3	11.9	54.8
05	253 25.9	54.4	30 01.2	15.6	2 16.4	12.0	54.8
06	268 25.9	N20 53.9	44 35.8	15.6	S 2 04.4	12.0	54.8
07	283 25.8	53.5	59 10.4	15.6	1 52.4	12.0	54.8
T 08	298 25.8	53.0	73 45.0	15.6	1 40.4	12.0	54.8
U 09	313 25.7	. . 52.6	88 19.6	15.7	1 28.4	11.9	54.7
E 10	328 25.7	52.1	102 54.3	15.6	1 16.5	12.0	54.7
S 11	343 25.7	51.7	117 28.9	15.7	1 04.5	12.0	54.7
D 12	358 25.6	N20 51.2	132 03.6	15.7	S 0 52.5	12.0	54.7
A 13	13 25.6	50.8	146 38.3	15.8	0 40.5	11.9	54.7
Y 14	28 25.5	50.3	161 13.1	15.7	0 28.6	12.0	54.7
15	43 25.5	. . 49.8	175 47.8	15.8	0 16.6	11.9	54.7
16	58 25.4	49.4	190 22.6	15.8	S 0 04.7	12.0	54.6
17	73 25.4	48.9	204 57.4	15.8	N 0 07.3	11.9	54.6
18	88 25.4	N20 48.5	219 32.2	15.8	N 0 19.2	11.9	54.6
19	103 25.3	48.0	234 07.0	15.8	0 31.1	11.9	54.6
20	118 25.3	47.6	248 41.8	15.9	0 43.0	12.0	54.6
21	133 25.2	. . 47.1	263 16.7	15.8	0 55.0	11.9	54.6
22	148 25.2	46.7	277 51.5	15.9	1 06.9	11.8	54.6
23	163 25.2	46.2	292 26.4	15.9	1 18.7	11.9	54.5
20 00	178 25.1	N20 45.7	307 01.3	15.9	N 1 30.6	11.9	54.5
01	193 25.1	45.3	321 36.2	15.9	1 42.5	11.8	54.5
02	208 25.1	44.8	336 11.1	15.9	1 54.3	11.9	54.5
03	223 25.0	. . 44.4	350 46.0	15.9	2 06.2	11.8	54.5
04	238 25.0	43.9	5 20.9	15.9	2 18.0	11.8	54.5
05	253 24.9	43.4	19 55.8	16.0	2 29.8	11.8	54.5
06	268 24.9	N20 43.0	34 30.8	15.9	N 2 41.6	11.8	54.5
W 07	283 24.9	42.5	49 05.7	15.9	2 53.4	11.7	54.5
E 08	298 24.8	42.0	63 40.6	16.0	3 05.1	11.8	54.4
D 09	313 24.8	. . 41.6	78 15.6	15.9	3 16.9	11.7	54.4
N 10	328 24.8	41.1	92 50.5	16.0	3 28.6	11.7	54.4
E 11	343 24.7	40.6	107 25.5	15.9	3 40.3	11.7	54.4
S 12	358 24.7	N20 40.2	122 00.4	15.9	N 3 52.0	11.6	54.4
D 13	13 24.6	39.7	136 35.3	16.0	4 03.6	11.7	54.4
A 14	28 24.6	39.2	151 10.3	15.9	4 15.3	11.6	54.4
Y 15	43 24.6	. . 38.8	165 45.2	15.9	4 26.9	11.6	54.4
16	58 24.5	38.3	180 20.1	16.0	4 38.5	11.6	54.4
17	73 24.5	37.8	194 55.1	15.9	4 50.1	11.5	54.4
18	88 24.5	N20 37.4	209 30.0	15.9	N 5 01.6	11.6	54.3
19	103 24.4	36.9	224 04.9	15.9	5 13.2	11.5	54.3
20	118 24.4	36.4	238 39.8	15.9	5 24.7	11.5	54.3
21	133 24.4	. . 35.9	253 14.7	15.9	5 36.2	11.4	54.3
22	148 24.3	35.5	267 49.6	15.9	5 47.6	11.4	54.3
23	163 24.3	35.0	282 24.5	15.9	N 5 59.0	11.4	54.3
	SD 15.8	d 0.5	SD	15.0		14.9	14.8

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		18	19	20	21
	h m	h m	h m	h m	h m	h m	h m
N 72	⊏	⊏	⊏	21 35	21 17	20 58	20 37
N 70	⊏	⊏	⊏	21 30	21 18	21 06	20 52
68	////	////	00 41	21 26	21 19	21 12	21 05
66	////	////	01 51	21 22	21 20	21 17	21 15
64	////	////	02 26	21 19	21 20	21 22	21 23
62	////	01 13	02 51	21 16	21 21	21 25	21 31
60	////	01 57	03 11	21 14	21 21	21 29	21 37
N 58	////	02 25	03 27	21 12	21 22	21 32	21 43
56	01 07	02 46	03 40	21 10	21 22	21 35	21 48
54	01 47	03 03	03 52	21 08	21 23	21 37	21 52
52	02 13	03 18	04 02	21 07	21 23	21 39	21 56
50	02 33	03 30	04 12	21 05	21 23	21 41	22 00
45	03 10	03 55	04 31	21 02	21 24	21 46	22 08
N 40	03 36	04 15	04 47	21 00	21 25	21 49	22 15
35	03 56	04 31	05 00	20 58	21 25	21 53	22 21
30	04 12	04 44	05 11	20 56	21 26	21 56	22 26
20	04 38	05 06	05 30	20 52	21 27	22 01	22 35
N 10	04 58	05 25	05 47	20 49	21 27	22 05	22 43
0	05 15	05 41	06 03	20 46	21 28	22 09	22 51
S 10	05 30	05 56	06 18	20 43	21 29	22 14	22 59
20	05 44	06 11	06 34	20 40	21 30	22 18	23 07
30	05 58	06 27	06 53	20 37	21 31	22 23	23 16
35	06 05	06 36	07 04	20 35	21 31	22 26	23 22
40	06 13	06 46	07 16	20 33	21 32	22 30	23 28
45	06 22	06 58	07 31	20 30	21 32	22 34	23 35
S 50	06 31	07 12	07 48	20 27	21 33	22 39	23 44
52	06 35	07 18	07 57	20 25	21 34	22 41	23 48
54	06 40	07 25	08 06	20 24	21 34	22 43	23 52
56	06 45	07 32	08 16	20 22	21 35	22 46	23 57
58	06 50	07 40	08 28	20 20	21 35	22 49	24 03
S 60	06 56	07 50	08 42	20 18	21 36	22 53	24 09

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	18	19	20	21
	h m	h m	h m	h m	h m	h m	h m
N 72	⊏	⊏	⊏	06 56	08 46	10 33	12 21
N 70	⊏	⊏	⊏	07 07	08 49	10 28	12 07
68	23 21	////	////	07 15	08 50	10 24	11 57
66	22 18	////	////	07 22	08 52	10 20	11 48
64	21 44	////	////	07 27	08 53	10 17	11 41
62	21 20	22 55	////	07 32	08 54	10 15	11 35
60	21 00	22 13	////	07 37	08 55	10 13	11 29
N 58	20 45	21 46	////	07 40	08 56	10 11	11 25
56	20 31	21 25	23 01	07 44	08 57	10 09	11 20
54	20 20	21 08	22 23	07 47	08 58	10 08	11 17
52	20 09	20 54	21 58	07 49	08 58	10 06	11 13
50	20 00	20 41	21 38	07 52	08 59	10 05	11 10
45	19 41	20 16	21 02	07 57	09 00	10 02	11 03
N 40	19 26	19 57	20 36	08 02	09 01	10 00	10 58
35	19 13	19 41	20 16	08 05	09 02	09 58	10 53
30	19 01	19 28	20 00	08 09	09 03	09 56	10 49
20	18 42	19 06	19 34	08 14	09 04	09 53	10 42
N 10	18 25	18 48	19 14	08 19	09 05	09 50	10 35
0	18 10	18 32	18 58	08 24	09 06	09 48	10 29
S 10	17 55	18 17	18 43	08 29	09 08	09 45	10 23
20	17 38	18 02	18 29	08 34	09 09	09 43	10 17
30	17 20	17 46	18 15	08 39	09 10	09 40	10 10
35	17 09	17 37	18 08	08 42	09 11	09 38	10 06
40	16 57	17 26	18 00	08 46	09 11	09 36	10 01
45	16 42	17 15	17 51	08 50	09 12	09 34	09 56
S 50	16 25	17 01	17 42	08 55	09 13	09 31	09 49
52	16 16	16 55	17 38	08 57	09 14	09 30	09 46
54	16 07	16 48	17 33	08 59	09 14	09 28	09 43
56	15 57	16 41	17 28	09 02	09 15	09 27	09 40
58	15 45	16 33	17 23	09 05	09 15	09 25	09 36
S 60	15 31	16 23	17 17	09 08	09 16	09 24	09 31

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00h	12h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
18	06 11	06 13	12 06	02 14	14 35	17	89
19	06 15	06 17	12 06	02 56	15 17	18	83
20	06 19	06 21	12 06	03 38	15 59	19	75

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.4		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
21 00	298 25.1	186 01.4	N22 25.0	218 18.3	N23 16.9	262 34.5	N12 56.2	106 48.0	S 2 22.2
01	313 27.6	201 00.6	24.6	233 18.9	17.0	277 36.6	56.3	121 50.3	22.3
02	328 30.0	215 59.8	24.2	248 19.5	17.2	292 38.8	56.4	136 52.6	22.3
03	343 32.5	230 58.9	23.9	263 20.1	17.3	307 41.0	56.5	151 55.0	22.4
04	358 35.0	245 58.1	23.5	278 20.7	17.5	322 43.1	56.5	166 57.3	22.5
05	13 37.4	260 57.3	23.1	293 21.3	17.6	337 45.3	56.6	181 59.6	22.5
06	28 39.9	275 56.4	N22 22.7	308 21.9	N23 17.8	352 47.5	N12 56.7	197 01.9	S 2 22.6
07	43 42.4	290 55.6	22.3	323 22.5	17.9	7 49.7	56.8	212 04.3	22.7
T 08	58 44.8	305 54.8	21.9	338 23.1	18.0	22 51.8	56.9	227 06.6	22.7
H 09	73 47.3	320 53.9	21.6	353 23.7	18.2	37 54.0	57.0	242 08.9	22.8
U 10	88 49.8	335 53.1	21.2	8 24.3	18.3	52 56.2	57.1	257 11.3	22.9
R 11	103 52.2	350 52.3	20.8	23 24.9	18.5	67 58.3	57.2	272 13.6	22.9
S 12	118 54.7	5 51.4	N22 20.4	38 25.5	N23 18.6	83 00.5	N12 57.3	287 15.9	S 2 23.0
D 13	133 57.2	20 50.6	20.0	53 26.2	18.8	98 02.7	57.3	302 18.2	23.1
A 14	148 59.6	35 49.8	19.6	68 26.8	18.9	113 04.9	57.4	317 20.6	23.1
Y 15	164 02.1	50 48.9	19.2	83 27.4	19.1	128 07.0	57.5	332 22.9	23.2
16	179 04.5	65 48.1	18.8	98 28.0	19.2	143 09.2	57.6	347 25.2	23.3
17	194 07.0	80 47.3	18.4	113 28.6	19.3	158 11.4	57.7	2 27.6	23.3
18	209 09.5	95 46.4	N22 18.0	128 29.2	N23 19.5	173 13.5	N12 57.8	17 29.9	S 2 23.4
19	224 11.9	110 45.6	17.6	143 29.8	19.6	188 15.7	57.9	32 32.2	23.5
20	239 14.4	125 44.8	17.2	158 30.4	19.8	203 17.9	58.0	47 34.5	23.5
21	254 16.9	140 44.0	16.8	173 31.0	19.9	218 20.1	58.0	62 36.9	23.6
22	269 19.3	155 43.1	16.4	188 31.6	20.0	233 22.2	58.1	77 39.2	23.7
23	284 21.8	170 42.3	16.0	203 32.2	20.2	248 24.4	58.2	92 41.5	23.7
22 00	299 24.3	185 41.5	N22 15.6	218 32.8	N23 20.3	263 26.6	N12 58.3	107 43.8	S 2 23.8
01	314 26.7	200 40.6	15.2	233 33.4	20.5	278 28.8	58.4	122 46.2	23.9
02	329 29.2	215 39.8	14.8	248 34.1	20.6	293 30.9	58.5	137 48.5	23.9
03	344 31.6	230 39.0	14.4	263 34.7	20.7	308 33.1	58.6	152 50.8	24.0
04	359 34.1	245 38.2	14.0	278 35.3	20.9	323 35.3	58.7	167 53.2	24.1
05	14 36.6	260 37.3	13.6	293 35.9	21.0	338 37.5	58.7	182 55.5	24.1
06	29 39.0	275 36.5	N22 13.2	308 36.5	N23 21.1	353 39.6	N12 58.8	197 57.8	S 2 24.2
07	44 41.5	290 35.7	12.8	323 37.1	21.3	8 41.8	58.9	213 00.1	24.3
08	59 44.0	305 34.8	12.4	338 37.7	21.4	23 44.0	59.0	228 02.5	24.3
F 09	74 46.4	320 34.0	12.0	353 38.3	21.6	38 46.2	59.1	243 04.8	24.4
R 10	89 48.9	335 33.2	11.6	8 38.9	21.7	53 48.3	59.2	258 07.1	24.5
I 11	104 51.4	350 32.4	11.1	23 39.5	21.8	68 50.5	59.3	273 09.4	24.6
D 12	119 53.8	5 31.5	N22 10.7	38 40.1	N23 22.0	83 52.7	N12 59.4	288 11.8	S 2 24.6
A 13	134 56.3	20 30.7	10.3	53 40.8	22.1	98 54.9	59.4	303 14.1	24.7
Y 14	149 58.8	35 29.9	09.9	68 41.4	22.2	113 57.1	59.5	318 16.4	24.8
15	165 01.2	50 29.1	09.5	83 42.0	22.4	128 59.2	59.6	333 18.7	24.8
16	180 03.7	65 28.3	09.1	98 42.6	22.5	144 01.4	59.7	348 21.1	24.9
17	195 06.1	80 27.4	08.6	113 43.2	22.6	159 03.6	59.8	3 23.4	25.0
18	210 08.6	95 26.6	N22 08.2	128 43.8	N23 22.8	174 05.8	N12 59.9	18 25.7	S 2 25.0
19	225 11.1	110 25.8	07.8	143 44.4	22.9	189 07.9	13 00.0	33 28.0	25.1
20	240 13.5	125 25.0	07.4	158 45.0	23.0	204 10.1	00.0	48 30.4	25.2
21	255 16.0	140 24.1	06.9	173 45.6	23.2	219 12.3	00.1	63 32.7	25.2
22	270 18.5	155 23.3	06.5	188 46.2	23.3	234 14.5	00.2	78 35.0	25.3
23	285 20.9	170 22.5	06.1	203 46.8	23.4	249 16.7	00.3	93 37.3	25.4
23 00	300 23.4	185 21.7	N22 05.6	218 47.5	N23 23.5	264 18.8	N13 00.4	108 39.7	S 2 25.5
01	315 25.9	200 20.9	05.2	233 48.1	23.7	279 21.0	00.5	123 42.0	25.5
02	330 28.3	215 20.0	04.8	248 48.7	23.8	294 23.2	00.6	138 44.3	25.6
03	345 30.8	230 19.2	04.4	263 49.3	23.9	309 25.4	00.6	153 46.6	25.7
04	0 33.3	245 18.4	03.9	278 49.9	24.1	324 27.6	00.7	168 48.9	25.7
05	15 35.7	260 17.6	03.5	293 50.5	24.2	339 29.7	00.8	183 51.3	25.8
06	30 38.2	275 16.8	N22 03.0	308 51.1	N23 24.3	354 31.9	N13 00.9	198 53.6	S 2 25.9
07	45 40.6	290 15.9	02.6	323 51.7	24.5	9 34.1	01.0	213 55.9	25.9
S 08	60 43.1	305 15.1	02.2	338 52.3	24.6	24 36.3	01.1	228 58.2	26.0
A 09	75 45.6	320 14.3	01.7	353 52.9	24.7	39 38.5	01.1	244 00.6	26.1
T 10	90 48.0	335 13.5	01.3	8 53.6	24.8	54 40.7	01.2	259 02.9	26.1
U 11	105 50.5	350 12.7	00.8	23 54.2	25.0	69 42.8	01.3	274 05.2	26.2
R 12	120 53.0	5 11.8	N22 00.4	38 54.8	N23 25.1	84 45.0	N13 01.4	289 07.5	S 2 26.3
D 13	135 55.4	20 11.0	22 00.0	53 55.4	25.2	99 47.2	01.5	304 09.8	26.4
A 14	150 57.9	35 10.2	21 59.5	68 56.0	25.3	114 49.4	01.6	319 12.2	26.4
Y 15	166 00.4	50 09.4	59.1	83 56.6	25.5	129 51.6	01.7	334 14.5	26.5
16	181 02.8	65 08.6	58.6	98 57.2	25.6	144 53.8	01.7	349 16.8	26.6
17	196 05.3	80 07.8	58.2	113 57.8	25.7	159 55.9	01.8	4 19.1	26.6
18	211 07.7	95 06.9	N21 57.7	128 58.4	N23 25.8	174 58.1	N13 01.9	19 21.5	S 2 26.7
19	226 10.2	110 06.1	57.3	143 59.1	26.0	190 00.3	02.0	34 23.8	26.8
20	241 12.7	125 05.3	56.8	158 59.7	26.1	205 02.5	02.1	49 26.1	26.8
21	256 15.1	140 04.5	56.4	174 00.3	26.2	220 04.7	02.2	64 28.4	26.9
22	271 17.6	155 03.7	55.9	189 00.9	26.3	235 06.9	02.2	79 30.7	27.0
23	286 20.1	170 02.9	55.5	204 01.5	26.4	250 09.1	02.3	94 33.1	27.1
	h m								
Mer. Pass.	4 01.7	v −0.8	d 0.4	v 0.6	d 0.1	v 2.2	d 0.1	v 2.3	d 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.2
Achernar	335 27.7	S57 10.3
Acrux	173 11.1	S63 10.2
Adhara	255 14.0	S28 59.3
Aldebaran	290 51.1	N16 31.9
Alioth	166 21.9	N55 54.0
Alkaid	152 59.9	N49 15.6
Al Na'ir	27 45.0	S46 54.0
Alnilam	275 48.0	S 1 11.7
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.0	N26 40.7
Alpheratz	357 44.7	N29 09.3
Altair	62 09.2	N 8 54.1
Ankaa	353 16.8	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 56.9	N19 07.4
Atria	107 30.3	S69 03.0
Avior	234 19.3	S59 32.9
Bellatrix	278 33.7	N 6 21.6
Betelgeuse	271 03.0	N 7 24.5
Canopus	263 57.3	S52 42.0
Capella	280 36.8	N46 00.4
Deneb	49 32.0	N45 19.4
Denebola	182 35.2	N14 30.5
Diphda	348 57.1	S17 55.1
Dubhe	193 53.7	N61 41.4
Elnath	278 14.6	N28 36.9
Eltanin	90 46.3	N51 29.5
Enif	33 48.1	N 9 55.9
Fomalhaut	15 25.2	S29 33.3
Gacrux	172 02.7	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.8	S60 26.0
Hamal	328 02.3	N23 31.0
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 19.5	N74 06.7
Markab	13 39.4	N15 16.2
Menkar	314 16.6	N 4 08.2
Menkent	148 09.1	S36 25.8
Miaplacidus	221 40.9	S69 46.1
Mirfak	308 42.5	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.7	S56 41.7
Pollux	243 29.7	N27 59.8
Procyon	245 01.5	N 5 11.7
Rasalhague	96 07.4	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.6	S 8 11.2
Rigil Kent.	139 53.5	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 41.9	N56 35.9
Shaula	96 23.4	S37 06.7
Sirius	258 35.2	S16 43.9
Spica	158 32.7	S11 13.4
Suhail	222 53.9	S43 28.9
Vega	80 39.5	N38 47.9
Zuben'ubi	137 06.8	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	246 17.2	11 38
Mars	279 08.6	9 25
Jupiter	324 02.3	6 25
Saturn	168 19.6	16 46

UT	SUN			MOON						
	GHA		Dec	GHA		v		Dec		d	HP
d h	°	′	° ′	°	′	′		°	′	′	′
21 00	178	24.3	N20 34.5	296	59.4	15.8	N	6	10.4	11.4	54.3
01	193	24.2	34.0	311	34.2	15.9		6	21.8	11.4	54.3
02	208	24.2	33.6	326	09.1	15.8		6	33.2	11.3	54.3
03	223	24.2	. . 33.1	340	43.9	15.8		6	44.5	11.3	54.3
04	238	24.1	32.6	355	18.7	15.8		6	55.8	11.2	54.3
05	253	24.1	32.1	9	53.5	15.8		7	07.0	11.3	54.3
06	268	24.1	N20 31.7	24	28.3	15.8	N	7	18.3	11.2	54.3
07	283	24.0	31.2	39	03.1	15.7		7	29.5	11.2	54.3
T 08	298	24.0	30.7	53	37.8	15.8		7	40.7	11.1	54.3
H 09	313	24.0	. . 30.2	68	12.6	15.7		7	51.8	11.1	54.3
U 10	328	24.0	29.7	82	47.3	15.7		8	02.9	11.1	54.3
R 11	343	23.9	29.3	97	22.0	15.7		8	14.0	11.0	54.2
S 12	358	23.9	N20 28.8	111	56.7	15.6	N	8	25.0	11.0	54.2
D 13	13	23.9	28.3	126	31.3	15.7		8	36.0	11.0	54.2
A 14	28	23.8	27.8	141	06.0	15.6		8	47.0	10.9	54.2
Y 15	43	23.8	. . 27.3	155	40.6	15.5		8	57.9	10.9	54.2
16	58	23.8	26.8	170	15.1	15.6		9	08.8	10.9	54.2
17	73	23.7	26.4	184	49.7	15.5		9	19.7	10.8	54.2
18	88	23.7	N20 25.9	199	24.2	15.5	N	9	30.5	10.8	54.2
19	103	23.7	25.4	213	58.7	15.5		9	41.3	10.7	54.2
20	118	23.7	24.9	228	33.2	15.5		9	52.0	10.7	54.2
21	133	23.6	. . 24.4	243	07.7	15.4		10	02.7	10.7	54.2
22	148	23.6	23.9	257	42.1	15.4		10	13.4	10.6	54.2
23	163	23.6	23.4	272	16.5	15.3		10	24.0	10.6	54.2
22 00	178	23.5	N20 23.0	286	50.8	15.4	N	10	34.6	10.5	54.2
01	193	23.5	22.5	301	25.2	15.3		10	45.1	10.6	54.2
02	208	23.5	22.0	315	59.5	15.2		10	55.7	10.4	54.2
03	223	23.5	. . 21.5	330	33.7	15.3		11	06.1	10.4	54.2
04	238	23.4	21.0	345	08.0	15.2		11	16.5	10.4	54.2
05	253	23.4	20.5	359	42.2	15.1		11	26.9	10.3	54.2
06	268	23.4	N20 20.0	14	16.3	15.1	N	11	37.2	10.3	54.2
07	283	23.4	19.5	28	50.4	15.1		11	47.5	10.2	54.2
08	298	23.3	19.0	43	24.5	15.1		11	57.7	10.2	54.2
F 09	313	23.3	. . 18.5	57	58.6	15.0		12	07.9	10.2	54.2
R 10	328	23.3	18.0	72	32.6	14.9		12	18.1	10.0	54.2
I 11	343	23.3	17.5	87	06.5	15.0		12	28.1	10.1	54.3
D 12	358	23.2	N20 17.0	101	40.5	14.9	N	12	38.2	10.0	54.3
A 13	13	23.2	16.5	116	14.4	14.8		12	48.2	9.9	54.3
Y 14	28	23.2	16.0	130	48.2	14.8		12	58.1	9.9	54.3
15	43	23.2	. . 15.5	145	22.0	14.8		13	08.0	9.8	54.3
16	58	23.1	15.1	159	55.8	14.7		13	17.8	9.8	54.3
17	73	23.1	14.6	174	29.5	14.7		13	27.6	9.8	54.3
18	88	23.1	N20 14.1	189	03.2	14.6	N	13	37.4	9.6	54.3
19	103	23.1	13.6	203	36.8	14.6		13	47.0	9.7	54.3
20	118	23.0	13.1	218	10.4	14.5		13	56.7	9.5	54.3
21	133	23.0	. . 12.6	232	43.9	14.5		14	06.2	9.6	54.3
22	148	23.0	12.0	247	17.4	14.5		14	15.8	9.4	54.3
23	163	23.0	11.5	261	50.9	14.3		14	25.2	9.4	54.3
23 00	178	23.0	N20 11.0	276	24.2	14.4	N	14	34.6	9.4	54.3
01	193	22.9	10.5	290	57.6	14.3		14	44.0	9.3	54.3
02	208	22.9	10.0	305	30.9	14.2		14	53.3	9.2	54.3
03	223	22.9	. . 09.5	320	04.1	14.2		15	02.5	9.2	54.3
04	238	22.9	09.0	334	37.3	14.2		15	11.7	9.1	54.4
05	253	22.9	08.5	349	10.5	14.1		15	20.8	9.0	54.4
06	268	22.8	N20 08.0	3	43.6	14.0	N	15	29.8	9.0	54.4
07	283	22.8	07.5	18	16.6	14.0		15	38.8	8.9	54.4
S 08	298	22.8	07.0	32	49.6	13.9		15	47.7	8.9	54.4
A 09	313	22.8	. . 06.5	47	22.5	13.9		15	56.6	8.8	54.4
T 10	328	22.8	06.0	61	55.4	13.8		16	05.4	8.7	54.4
U 11	343	22.7	05.5	76	28.2	13.8		16	14.1	8.7	54.4
R 12	358	22.7	N20 05.0	91	01.0	13.7	N	16	22.8	8.6	54.4
D 13	13	22.7	04.5	105	33.7	13.6		16	31.4	8.5	54.4
A 14	28	22.7	03.9	120	06.3	13.6		16	39.9	8.5	54.5
Y 15	43	22.7	. . 03.4	134	38.9	13.5		16	48.4	8.4	54.5
16	58	22.6	02.9	149	11.4	13.5		16	56.8	8.3	54.5
17	73	22.6	02.4	163	43.9	13.4		17	05.1	8.3	54.5
18	88	22.6	N20 01.9	178	16.3	13.4	N	17	13.4	8.2	54.5
19	103	22.6	01.4	192	48.7	13.3		17	21.6	8.1	54.5
20	118	22.6	00.9	207	21.0	13.2		17	29.7	8.1	54.5
21	133	22.6	20 00.3	221	53.2	13.2		17	37.8	7.9	54.5
22	148	22.5	19 59.8	236	25.4	13.1		17	45.7	7.9	54.6
23	163	22.5	N19 59.3	250	57.5	13.1	N	17	53.6	7.9	54.6
	SD	15.8	d 0.5	SD		14.8			14.8		14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 21	Moonrise 22	Moonrise 23	Moonrise 24
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	20 37	20 10	19 15	▭
N 70	▭	▭	▭	20 52	20 36	20 13	▭
68	////	////	01 11	21 05	20 57	20 47	20 32
66	////	////	02 04	21 15	21 13	21 12	21 12
64	////	////	02 35	21 23	21 26	21 31	21 40
62	////	01 29	02 59	21 31	21 37	21 47	22 02
60	////	02 06	03 17	21 37	21 47	22 00	22 20
N 58	////	02 32	03 32	21 43	21 56	22 12	22 34
56	01 21	02 52	03 45	21 48	22 03	22 22	22 47
54	01 56	03 09	03 57	21 52	22 10	22 31	22 58
52	02 20	03 22	04 06	21 56	22 16	22 39	23 08
50	02 39	03 34	04 15	22 00	22 21	22 46	23 16
45	03 14	03 59	04 34	22 08	22 33	23 01	23 35
N 40	03 39	04 18	04 49	22 15	22 43	23 14	23 50
35	03 58	04 33	05 02	22 21	22 51	23 25	24 03
30	04 14	04 46	05 13	22 26	22 59	23 35	24 14
20	04 39	05 08	05 32	22 35	23 12	23 51	24 34
N 10	04 59	05 25	05 48	22 43	23 23	24 05	00 05
0	05 15	05 41	06 03	22 51	23 34	24 19	00 19
S 10	05 30	05 55	06 18	22 59	23 45	24 33	00 33
20	05 43	06 10	06 34	23 07	23 56	24 47	00 47
30	05 57	06 26	06 52	23 16	24 10	00 10	01 04
35	06 04	06 35	07 02	23 22	24 17	00 17	01 14
40	06 11	06 45	07 14	23 28	24 26	00 26	01 25
45	06 20	06 56	07 28	23 35	24 37	00 37	01 39
S 50	06 29	07 09	07 45	23 44	24 49	00 49	01 55
52	06 33	07 15	07 53	23 48	24 55	00 55	02 03
54	06 37	07 21	08 02	23 52	25 02	01 02	02 11
56	06 42	07 28	08 12	23 57	25 09	01 09	02 21
58	06 47	07 36	08 24	24 03	00 03	01 17	02 32
S 60	06 52	07 45	08 37	24 09	00 09	01 27	02 45

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 21	Moonset 22	Moonset 23	Moonset 24
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	12 21	14 17	16 44	▭
N 70	▭	▭	▭	12 07	13 52	15 47	▭
68	22 55	////	////	11 57	13 33	15 14	17 06
66	22 06	////	////	11 48	13 18	14 50	16 26
64	21 35	////	////	11 41	13 05	14 32	15 59
62	21 12	22 40	////	11 35	12 55	14 17	15 38
60	20 54	22 04	////	11 29	12 46	14 04	15 21
N 58	20 39	21 39	////	11 25	12 39	13 53	15 07
56	20 26	21 19	22 48	11 20	12 32	13 43	14 55
54	20 15	21 03	22 15	11 17	12 26	13 35	14 44
52	20 06	20 49	21 51	11 13	12 20	13 28	14 35
50	19 57	20 37	21 33	11 10	12 15	13 21	14 26
45	19 38	20 13	20 58	11 03	12 05	13 06	14 08
N 40	19 23	19 55	20 33	10 58	11 56	12 55	13 54
35	19 11	19 39	20 14	10 53	11 49	12 45	13 41
30	19 00	19 26	19 58	10 49	11 42	12 36	13 31
20	18 41	19 05	19 33	10 42	11 31	12 21	13 12
N 10	18 25	18 47	19 14	10 35	11 21	12 08	12 56
0	18 10	18 32	18 58	10 29	11 12	11 55	12 42
S 10	17 55	18 17	18 43	10 23	11 02	11 43	12 27
20	17 39	18 03	18 30	10 17	10 53	11 30	12 11
30	17 21	17 47	18 16	10 10	10 41	11 15	11 53
35	17 11	17 38	18 09	10 06	10 35	11 07	11 42
40	16 59	17 29	18 02	10 01	10 28	10 57	11 30
45	16 45	17 18	17 54	09 56	10 19	10 46	11 16
S 50	16 28	17 05	17 45	09 49	10 09	10 32	10 59
52	16 20	16 59	17 41	09 46	10 04	10 25	10 51
54	16 11	16 52	17 36	09 43	09 59	10 18	10 42
56	16 01	16 45	17 32	09 40	09 54	10 10	10 32
58	15 50	16 37	17 27	09 36	09 47	10 02	10 20
S 60	15 37	16 28	17 21	09 31	09 40	09 51	10 07

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
21	06 23	06 24	12 06	04 19	16 40	20	66
22	06 26	06 27	12 06	05 01	17 23	21	57
23	06 28	06 29	12 06	05 45	18 07	22	47

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.4		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
24 00	301 22.5	185 02.1	N21 55.0	219 02.1	N23 26.6	265 11.2	N13 02.4	109 35.4	S 2 27.1
01	316 25.0	200 01.2	54.5	234 02.7	26.7	280 13.4	02.5	124 37.7	27.2
02	331 27.5	215 00.4	54.1	249 03.3	26.8	295 15.6	02.6	139 40.0	27.3
03	346 29.9	229 59.6	53.6	264 03.9	26.9	310 17.8	02.7	154 42.3	27.3
04	1 32.4	244 58.8	53.2	279 04.6	27.1	325 20.0	02.7	169 44.7	27.4
05	16 34.9	259 58.0	52.7	294 05.2	27.2	340 22.2	02.8	184 47.0	27.5
06	31 37.3	274 57.2	N21 52.2	309 05.8	N23 27.3	355 24.4	N13 02.9	199 49.3	S 2 27.6
07	46 39.8	289 56.4	51.8	324 06.4	27.4	10 26.6	03.0	214 51.6	27.6
08	61 42.2	304 55.6	51.3	339 07.0	27.5	25 28.7	03.1	229 53.9	27.7
S 09	76 44.7	319 54.7	50.8	354 07.6	27.6	40 30.9	03.2	244 56.3	27.8
U 10	91 47.2	334 53.9	50.4	9 08.2	27.8	55 33.1	03.2	259 58.6	27.8
N 11	106 49.6	349 53.1	49.9	24 08.8	27.9	70 35.3	03.3	275 00.9	27.9
D 12	121 52.1	4 52.3	N21 49.4	39 09.4	N23 28.0	85 37.5	N13 03.4	290 03.2	S 2 28.0
A 13	136 54.6	19 51.5	49.0	54 10.1	28.1	100 39.7	03.5	305 05.5	28.0
Y 14	151 57.0	34 50.7	48.5	69 10.7	28.2	115 41.9	03.6	320 07.8	28.1
15	166 59.5	49 49.9	48.0	84 11.3	28.3	130 44.1	03.6	335 10.2	28.2
16	182 02.0	64 49.1	47.6	99 11.9	28.5	145 46.3	03.7	350 12.5	28.3
17	197 04.4	79 48.3	47.1	114 12.5	28.6	160 48.5	03.8	5 14.8	28.3
18	212 06.9	94 47.5	N21 46.6	129 13.1	N23 28.7	175 50.6	N13 03.9	20 17.1	S 2 28.4
19	227 09.4	109 46.6	46.1	144 13.7	28.8	190 52.8	04.0	35 19.4	28.5
20	242 11.8	124 45.8	45.6	159 14.3	28.9	205 55.0	04.1	50 21.8	28.5
21	257 14.3	139 45.0	45.2	174 15.0	29.0	220 57.2	04.1	65 24.1	28.6
22	272 16.7	154 44.2	44.7	189 15.6	29.2	235 59.4	04.2	80 26.4	28.7
23	287 19.2	169 43.4	44.2	204 16.2	29.3	251 01.6	04.3	95 28.7	28.8
25 00	302 21.7	184 42.6	N21 43.7	219 16.8	N23 29.4	266 03.8	N13 04.4	110 31.0	S 2 28.8
01	317 24.1	199 41.8	43.2	234 17.4	29.5	281 06.0	04.5	125 33.3	28.9
02	332 26.6	214 41.0	42.7	249 18.0	29.6	296 08.2	04.5	140 35.7	29.0
03	347 29.1	229 40.2	42.3	264 18.6	29.7	311 10.4	04.6	155 38.0	29.1
04	2 31.5	244 39.4	41.8	279 19.2	29.8	326 12.6	04.7	170 40.3	29.1
05	17 34.0	259 38.6	41.3	294 19.9	29.9	341 14.8	04.8	185 42.6	29.2
06	32 36.5	274 37.8	N21 40.8	309 20.5	N23 30.0	356 17.0	N13 04.9	200 44.9	S 2 29.3
07	47 38.9	289 37.0	40.3	324 21.1	30.2	11 19.2	04.9	215 47.2	29.3
08	62 41.4	304 36.2	39.8	339 21.7	30.3	26 21.3	05.0	230 49.6	29.4
M 09	77 43.8	319 35.4	39.3	354 22.3	30.4	41 23.5	05.1	245 51.9	29.5
O 10	92 46.3	334 34.6	38.8	9 22.9	30.5	56 25.7	05.2	260 54.2	29.6
N 11	107 48.8	349 33.8	38.3	24 23.5	30.6	71 27.9	05.3	275 56.5	29.6
D 12	122 51.2	4 33.0	N21 37.8	39 24.1	N23 30.7	86 30.1	N13 05.3	290 58.8	S 2 29.7
A 13	137 53.7	19 32.2	37.3	54 24.8	30.8	101 32.3	05.4	306 01.1	29.8
Y 14	152 56.2	34 31.4	36.8	69 25.4	30.9	116 34.5	05.5	321 03.5	29.8
15	167 58.6	49 30.6	36.3	84 26.0	31.0	131 36.7	05.6	336 05.8	29.9
16	183 01.1	64 29.8	35.8	99 26.6	31.1	146 38.9	05.7	351 08.1	30.0
17	198 03.6	79 29.0	35.3	114 27.2	31.2	161 41.1	05.7	6 10.4	30.1
18	213 06.0	94 28.2	N21 34.8	129 27.8	N23 31.3	176 43.3	N13 05.8	21 12.7	S 2 30.1
19	228 08.5	109 27.4	34.3	144 28.4	31.5	191 45.5	05.9	36 15.0	30.2
20	243 11.0	124 26.6	33.8	159 29.1	31.6	206 47.7	06.0	51 17.3	30.3
21	258 13.4	139 25.8	33.3	174 29.7	31.7	221 49.9	06.1	66 19.7	30.4
22	273 15.9	154 25.0	32.8	189 30.3	31.8	236 52.1	06.1	81 22.0	30.4
23	288 18.3	169 24.2	32.3	204 30.9	31.9	251 54.3	06.2	96 24.3	30.5
26 00	303 20.8	184 23.4	N21 31.8	219 31.5	N23 32.0	266 56.5	N13 06.3	111 26.6	S 2 30.6
01	318 23.3	199 22.6	31.3	234 32.1	32.1	281 58.7	06.4	126 28.9	30.6
02	333 25.7	214 21.8	30.8	249 32.7	32.2	297 00.9	06.4	141 31.2	30.7
03	348 28.2	229 21.0	30.3	264 33.4	32.3	312 03.1	06.5	156 33.5	30.8
04	3 30.7	244 20.2	29.7	279 34.0	32.4	327 05.3	06.6	171 35.9	30.9
05	18 33.1	259 19.4	29.2	294 34.6	32.5	342 07.5	06.7	186 38.2	30.9
06	33 35.6	274 18.6	N21 28.7	309 35.2	N23 32.6	357 09.7	N13 06.8	201 40.5	S 2 31.0
07	48 38.1	289 17.8	28.2	324 35.8	32.7	12 11.9	06.8	216 42.8	31.1
T 08	63 40.5	304 17.0	27.7	339 36.4	32.8	27 14.1	06.9	231 45.1	31.2
U 09	78 43.0	319 16.2	27.2	354 37.0	32.9	42 16.3	07.0	246 47.4	31.2
E 10	93 45.5	334 15.4	26.6	9 37.7	33.0	57 18.5	07.1	261 49.7	31.3
S 11	108 47.9	349 14.6	26.1	24 38.3	33.1	72 20.7	07.1	276 52.0	31.4
D 12	123 50.4	4 13.8	N21 25.6	39 38.9	N23 33.2	87 22.9	N13 07.2	291 54.4	S 2 31.5
A 13	138 52.8	19 13.0	25.1	54 39.5	33.3	102 25.1	07.3	306 56.7	31.5
Y 14	153 55.3	34 12.2	24.6	69 40.1	33.4	117 27.3	07.4	321 59.0	31.6
15	168 57.8	49 11.4	24.0	84 40.7	33.5	132 29.5	07.5	337 01.3	31.7
16	184 00.2	64 10.7	23.5	99 41.4	33.6	147 31.7	07.5	352 03.6	31.7
17	199 02.7	79 09.9	23.0	114 42.0	33.7	162 33.9	07.6	7 05.9	31.8
18	214 05.2	94 09.1	N21 22.4	129 42.6	N23 33.8	177 36.1	N13 07.7	22 08.2	S 2 31.9
19	229 07.6	109 08.3	21.9	144 43.2	33.9	192 38.3	07.8	37 10.5	32.0
20	244 10.1	124 07.5	21.4	159 43.8	34.0	207 40.5	07.8	52 12.9	32.0
21	259 12.6	139 06.7	20.9	174 44.4	34.1	222 42.7	07.9	67 15.2	32.1
22	274 15.0	154 05.9	20.3	189 45.0	34.2	237 44.9	08.0	82 17.5	32.2
23	289 17.5	169 05.1	19.8	204 45.7	34.3	252 47.1	08.1	97 19.8	32.3
	h m								
Mer. Pass.	3 49.9	*v* −0.8	*d* 0.5	*v* 0.6	*d* 0.1	*v* 2.2	*d* 0.1	*v* 2.3	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.2
Achernar	335 27.6	S57 10.3
Acrux	173 11.1	S63 10.1
Adhara	255 13.9	S28 59.3
Aldebaran	290 51.1	N16 31.9
Alioth	166 21.9	N55 54.0
Alkaid	152 59.9	N49 15.6
Al Na'ir	27 44.9	S46 54.0
Alnilam	275 48.0	S 1 11.7
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.0	N26 40.7
Alpheratz	357 44.7	N29 09.3
Altair	62 09.2	N 8 54.1
Ankaa	353 16.8	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 56.9	N19 07.4
Atria	107 30.3	S69 03.1
Avior	234 19.3	S59 32.9
Bellatrix	278 33.7	N 6 21.6
Betelgeuse	271 03.0	N 7 24.5
Canopus	263 57.2	S52 42.0
Capella	280 36.8	N46 00.4
Deneb	49 31.9	N45 19.4
Denebola	182 35.2	N14 30.5
Diphda	348 57.1	S17 55.1
Dubhe	193 53.7	N61 41.4
Elnath	278 14.6	N28 36.9
Eltanin	90 46.3	N51 29.5
Enif	33 48.1	N 9 55.9
Fomalhaut	15 25.1	S29 33.3
Gacrux	172 02.7	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.8	S60 26.0
Hamal	328 02.3	N23 31.0
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 19.6	N74 06.8
Markab	13 39.4	N15 16.2
Menkar	314 16.5	N 4 08.2
Menkent	148 09.2	S36 25.8
Miaplacidus	221 41.0	S69 46.1
Mirfak	308 42.5	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.7	S56 41.7
Pollux	243 29.7	N27 59.8
Procyon	245 01.4	N 5 11.7
Rasalhague	96 07.4	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.6	S 8 11.2
Rigil Kent.	139 53.5	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 41.9	N56 35.9
Shaula	96 23.4	S37 06.7
Sirius	258 35.2	S16 43.9
Spica	158 32.7	S11 13.4
Suhail	222 53.9	S43 28.9
Vega	80 39.5	N38 47.9
Zuben'ubi	137 06.8	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	242 20.9	11 42
Mars	276 55.1	9 22
Jupiter	323 42.1	6 15
Saturn	168 09.4	16 35

2011 JULY 24, 25, 26 (SUN., MON., TUES.)

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
24 00	178 22.5	N19 58.8	265 29.6	13.0	N18 01.5	7.7	54.6
01	193 22.5	58.3	280 01.6	12.9	18 09.2	7.7	54.6
02	208 22.5	57.8	294 33.5	12.9	18 16.9	7.6	54.6
03	223 22.5	. . 57.2	309 05.4	12.8	18 24.5	7.5	54.6
04	238 22.5	56.7	323 37.2	12.7	18 32.0	7.5	54.6
05	253 22.4	56.2	338 08.9	12.7	18 39.5	7.3	54.7
06	268 22.4	N19 55.7	352 40.6	12.6	N18 46.8	7.3	54.7
07	283 22.4	55.2	7 12.2	12.6	18 54.1	7.2	54.7
08	298 22.4	54.6	21 43.8	12.5	19 01.3	7.2	54.7
S 09	313 22.4	. . 54.1	36 15.3	12.4	19 08.5	7.0	54.7
U 10	328 22.4	53.6	50 46.7	12.3	19 15.5	7.0	54.7
N 11	343 22.4	53.1	65 18.0	12.3	19 22.5	6.8	54.8
D 12	358 22.3	N19 52.5	79 49.3	12.2	N19 29.3	6.8	54.8
A 13	13 22.3	52.0	94 20.5	12.2	19 36.1	6.7	54.8
Y 14	28 22.3	51.5	108 51.7	12.1	19 42.8	6.7	54.8
15	43 22.3	. . 51.0	123 22.8	12.0	19 49.5	6.5	54.8
16	58 22.3	50.4	137 53.8	12.0	19 56.0	6.5	54.9
17	73 22.3	49.9	152 24.8	11.9	20 02.5	6.3	54.9
18	88 22.3	N19 49.4	166 55.7	11.8	N20 08.8	6.3	54.9
19	103 22.3	48.9	181 26.5	11.8	20 15.1	6.2	54.9
20	118 22.3	48.3	195 57.3	11.7	20 21.3	6.1	54.9
21	133 22.2	. . 47.8	210 28.0	11.6	20 27.4	6.0	55.0
22	148 22.2	47.3	224 58.6	11.5	20 33.4	5.9	55.0
23	163 22.2	46.7	239 29.1	11.5	20 39.3	5.8	55.0
25 00	178 22.2	N19 46.2	253 59.6	11.5	N20 45.1	5.7	55.0
01	193 22.2	45.7	268 30.1	11.3	20 50.8	5.6	55.0
02	208 22.2	45.2	283 00.4	11.3	20 56.4	5.6	55.1
03	223 22.2	. . 44.6	297 30.7	11.2	21 02.0	5.4	55.1
04	238 22.2	44.1	312 00.9	11.2	21 07.4	5.3	55.1
05	253 22.2	43.6	326 31.1	11.1	21 12.7	5.3	55.1
06	268 22.2	N19 43.0	341 01.2	11.0	N21 18.0	5.1	55.1
07	283 22.1	42.5	355 31.2	11.0	21 23.1	5.0	55.2
08	298 22.1	42.0	10 01.2	10.9	21 28.1	5.0	55.2
M 09	313 22.1	. . 41.4	24 31.1	10.8	21 33.1	4.8	55.2
O 10	328 22.1	40.9	39 00.9	10.8	21 37.9	4.8	55.2
N 11	343 22.1	40.3	53 30.7	10.7	21 42.7	4.6	55.3
D 12	358 22.1	N19 39.8	68 00.4	10.6	N21 47.3	4.5	55.3
A 13	13 22.1	39.3	82 30.0	10.6	21 51.8	4.4	55.3
Y 14	28 22.1	38.7	96 59.6	10.5	21 56.2	4.4	55.3
15	43 22.1	. . 38.2	111 29.1	10.4	22 00.6	4.2	55.4
16	58 22.1	37.6	125 58.5	10.4	22 04.8	4.1	55.4
17	73 22.1	37.1	140 27.9	10.3	22 08.9	4.0	55.4
18	88 22.1	N19 36.6	154 57.2	10.2	N22 12.9	3.9	55.4
19	103 22.1	36.0	169 26.4	10.2	22 16.8	3.8	55.5
20	118 22.1	35.5	183 55.6	10.1	22 20.6	3.6	55.5
21	133 22.1	. . 34.9	198 24.7	10.1	22 24.2	3.6	55.5
22	148 22.1	34.4	212 53.8	9.9	22 27.8	3.5	55.5
23	163 22.1	33.9	227 22.7	10.0	22 31.3	3.3	55.6
26 00	178 22.0	N19 33.3	241 51.7	9.8	N22 34.6	3.2	55.6
01	193 22.0	32.8	256 20.5	9.9	22 37.8	3.2	55.6
02	208 22.0	32.2	270 49.4	9.7	22 41.0	3.0	55.6
03	223 22.0	. . 31.7	285 18.1	9.7	22 44.0	2.8	55.7
04	238 22.0	31.1	299 46.8	9.6	22 46.8	2.8	55.7
05	253 22.0	30.6	314 15.4	9.6	22 49.6	2.7	55.7
06	268 22.0	N19 30.0	328 44.0	9.5	N22 52.3	2.5	55.8
07	283 22.0	29.5	343 12.5	9.5	22 54.8	2.4	55.8
T 08	298 22.0	28.9	357 41.0	9.4	22 57.2	2.3	55.8
U 09	313 22.0	. . 28.4	12 09.4	9.3	22 59.5	2.2	55.8
E 10	328 22.0	27.8	26 37.7	9.3	23 01.7	2.1	55.9
S 11	343 22.0	27.3	41 06.0	9.2	23 03.8	1.9	55.9
D 12	358 22.0	N19 26.7	55 34.2	9.2	N23 05.7	1.8	55.9
A 13	13 22.0	26.2	70 02.4	9.1	23 07.5	1.7	56.0
Y 14	28 22.0	25.6	84 30.5	9.1	23 09.2	1.6	56.0
15	43 22.0	. . 25.1	98 58.6	9.0	23 10.8	1.5	56.0
16	58 22.0	24.5	113 26.6	9.0	23 12.3	1.3	56.0
17	73 22.0	24.0	127 54.6	8.9	23 13.6	1.2	56.1
18	88 22.0	N19 23.4	142 22.5	8.9	N23 14.8	1.1	56.1
19	103 22.0	22.9	156 50.4	8.8	23 15.9	1.0	56.1
20	118 22.0	22.3	171 18.2	8.8	23 16.9	0.8	56.2
21	133 22.0	. . 21.7	185 46.0	8.7	23 17.7	0.7	56.2
22	148 22.0	21.2	200 13.7	8.7	23 18.4	0.6	56.2
23	163 22.0	20.6	214 41.4	8.6	N23 19.0	0.4	56.3
	SD 15.8	d 0.5	SD	14.9		15.1	15.2

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		24	25	26	27
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70							
68	////	////	01 33	20 32			
66	////	////	02 16	21 12	21 18	21 42	22 51
64	////	00 39	02 45	21 40	21 59	22 34	23 38
62	////	01 43	03 06	22 02	22 26	23 07	24 09
60	////	02 16	03 24	22 20	22 48	23 31	24 31
N 58	00 36	02 40	03 38	22 34	23 06	23 50	24 50
56	01 34	02 59	03 50	22 47	23 20	24 06	00 06
54	02 05	03 14	04 01	22 58	23 33	24 20	00 20
52	02 27	03 27	04 11	23 08	23 44	24 32	00 32
50	02 45	03 39	04 19	23 16	23 54	24 42	00 42
45	03 18	04 02	04 37	23 35	24 15	00 15	01 04
N 40	03 42	04 21	04 52	23 50	24 33	00 33	01 22
35	04 01	04 36	05 04	24 03	00 03	00 47	01 37
30	04 16	04 48	05 15	24 14	00 14	00 59	01 50
20	04 41	05 09	05 33	24 34	00 34	01 21	02 13
N 10	05 00	05 26	05 48	00 05	00 51	01 40	02 32
0	05 15	05 41	06 03	00 19	01 07	01 57	02 50
S 10	05 29	05 55	06 17	00 33	01 23	02 15	03 08
20	05 43	06 09	06 33	00 47	01 40	02 33	03 28
30	05 55	06 25	06 50	01 04	02 00	02 55	03 50
35	06 02	06 33	07 00	01 14	02 11	03 08	04 03
40	06 09	06 42	07 12	01 25	02 24	03 23	04 18
45	06 17	06 53	07 25	01 39	02 40	03 40	04 36
S 50	06 26	07 05	07 42	01 55	03 00	04 02	04 59
52	06 29	07 11	07 49	02 03	03 09	04 12	05 10
54	06 33	07 17	07 58	02 11	03 20	04 24	05 22
56	06 38	07 24	08 07	02 21	03 31	04 38	05 36
58	06 43	07 32	08 18	02 32	03 45	04 53	05 52
S 60	06 48	07 40	08 31	02 45	04 01	05 12	06 12

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	24	25	26	27
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70							
68	22 35	////	////	17 06			
66	21 54	////	////	16 26	18 04	19 29	20 13
64	21 26	23 22	////	15 59	17 24	18 37	19 26
62	21 05	22 26	////	15 38	16 56	18 04	18 56
60	20 48	21 54	////	15 21	16 35	17 41	18 32
N 58	20 34	21 31	23 27	15 07	16 18	17 21	18 14
56	20 21	21 13	22 35	14 55	16 03	17 05	17 58
54	20 11	20 57	22 06	14 44	15 51	16 52	17 45
52	20 01	20 44	21 44	14 35	15 39	16 40	17 33
50	19 53	20 33	21 27	14 26	15 30	16 29	17 23
45	19 35	20 10	20 54	14 08	15 09	16 07	17 01
N 40	19 21	19 52	20 30	13 54	14 52	15 49	16 43
35	19 09	19 37	20 11	13 41	14 38	15 35	16 28
30	18 58	19 24	19 56	13 31	14 26	15 22	16 15
20	18 40	19 04	19 32	13 12	14 05	14 59	15 53
N 10	18 25	18 47	19 13	12 56	13 47	14 40	15 34
0	18 10	18 32	18 58	12 42	13 31	14 22	15 16
S 10	17 56	18 18	18 44	12 27	13 14	14 04	14 58
20	17 41	18 04	18 31	12 11	12 56	13 45	14 39
30	17 23	17 49	18 18	11 53	12 35	13 23	14 17
35	17 13	17 40	18 11	11 42	12 23	13 10	14 03
40	17 02	17 31	18 04	11 30	12 09	12 55	13 48
45	16 48	17 21	17 56	11 16	11 53	12 37	13 30
S 50	16 32	17 08	17 48	10 59	11 33	12 15	13 08
52	16 24	17 02	17 44	10 51	11 23	12 05	12 57
54	16 16	16 56	17 40	10 42	11 12	11 53	12 45
56	16 06	16 49	17 36	10 32	11 00	11 39	12 31
58	15 55	16 42	17 31	10 20	10 46	11 23	12 15
S 60	15 43	16 33	17 26	10 07	10 30	11 04	11 55

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00h	12h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
24	06 30	06 31	12 07	06 30	18 54	23	38
25	06 31	06 32	12 07	07 19	19 44	24	29
26	06 32	06 32	12 07	08 10	20 36	25	20

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.4		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
27 00	304 20.0	184 04.3	N21 19.2	219 46.3	N23 34.4	267 49.3	N13 08.1	112 22.1	S 2 32.3
01	319 22.4	199 03.5	18.7	234 46.9	34.5	282 51.5	08.2	127 24.4	32.4
02	334 24.9	214 02.8	18.2	249 47.5	34.6	297 53.8	08.3	142 26.7	32.5
03	349 27.3	229 02.0	17.6	264 48.1	34.7	312 56.0	08.4	157 29.0	32.6
04	4 29.8	244 01.2	17.1	279 48.7	34.7	327 58.2	08.5	172 31.3	32.6
05	19 32.3	259 00.4	16.6	294 49.4	34.8	343 00.4	08.5	187 33.7	32.7
06	34 34.7	273 59.6	N21 16.0	309 50.0	N23 34.9	358 02.6	N13 08.6	202 36.0	S 2 32.8
W 07	49 37.2	288 58.8	15.5	324 50.6	35.0	13 04.8	08.7	217 38.3	32.9
E 08	64 39.7	303 58.0	14.9	339 51.2	35.1	28 07.0	08.8	232 40.6	32.9
D 09	79 42.1	318 57.2	14.4	354 51.8	35.2	43 09.2	08.8	247 42.9	33.0
N 10	94 44.6	333 56.5	13.8	9 52.4	35.3	58 11.4	08.9	262 45.2	33.1
E 11	109 47.1	348 55.7	13.3	24 53.1	35.4	73 13.6	09.0	277 47.5	33.2
S 12	124 49.5	3 54.9	N21 12.7	39 53.7	N23 35.5	88 15.8	N13 09.1	292 49.8	S 2 33.2
D 13	139 52.0	18 54.1	12.2	54 54.3	35.6	103 18.0	09.1	307 52.1	33.3
A 14	154 54.5	33 53.3	11.6	69 54.9	35.7	118 20.2	09.2	322 54.4	33.4
Y 15	169 56.9	48 52.5	11.1	84 55.5	35.8	133 22.5	09.3	337 56.7	33.5
16	184 59.4	63 51.8	10.5	99 56.1	35.8	148 24.7	09.4	352 59.1	33.5
17	200 01.8	78 51.0	10.0	114 56.8	35.9	163 26.9	09.4	8 01.4	33.6
18	215 04.3	93 50.2	N21 09.4	129 57.4	N23 36.0	178 29.1	N13 09.5	23 03.7	S 2 33.7
19	230 06.8	108 49.4	08.9	144 58.0	36.1	193 31.3	09.6	38 06.0	33.8
20	245 09.2	123 48.6	08.3	159 58.6	36.2	208 33.5	09.7	53 08.3	33.8
21	260 11.7	138 47.8	07.8	174 59.2	36.3	223 35.7	09.7	68 10.6	33.9
22	275 14.2	153 47.1	07.2	189 59.9	36.4	238 37.9	09.8	83 12.9	34.0
23	290 16.6	168 46.3	06.6	205 00.5	36.5	253 40.1	09.9	98 15.2	34.1
28 00	305 19.1	183 45.5	N21 06.1	220 01.1	N23 36.6	268 42.3	N13 10.0	113 17.5	S 2 34.1
01	320 21.6	198 44.7	05.5	235 01.7	36.6	283 44.6	10.0	128 19.8	34.2
02	335 24.0	213 43.9	05.0	250 02.3	36.7	298 46.8	10.1	143 22.1	34.3
03	350 26.5	228 43.2	04.4	265 02.9	36.8	313 49.0	10.2	158 24.4	34.4
04	5 28.9	243 42.4	03.8	280 03.6	36.9	328 51.2	10.2	173 26.8	34.4
05	20 31.4	258 41.6	03.3	295 04.2	37.0	343 53.4	10.3	188 29.1	34.5
06	35 33.9	273 40.8	N21 02.7	310 04.8	N23 37.1	358 55.6	N13 10.4	203 31.4	S 2 34.6
T 07	50 36.3	288 40.0	02.1	325 05.4	37.1	13 57.8	10.5	218 33.7	34.7
H 08	65 38.8	303 39.3	01.6	340 06.0	37.2	29 00.0	10.5	233 36.0	34.7
U 09	80 41.3	318 38.5	01.0	355 06.7	37.3	44 02.3	10.6	248 38.3	34.8
R 10	95 43.7	333 37.7	21 00.4	10 07.3	37.4	59 04.5	10.7	263 40.6	34.9
S 11	110 46.2	348 36.9	20 59.8	25 07.9	37.5	74 06.7	10.8	278 42.9	35.0
D 12	125 48.7	3 36.2	N20 59.3	40 08.5	N23 37.6	89 08.9	N13 10.8	293 45.2	S 2 35.0
A 13	140 51.1	18 35.4	58.7	55 09.1	37.6	104 11.1	10.9	308 47.5	35.1
Y 14	155 53.6	33 34.6	58.1	70 09.8	37.7	119 13.3	11.0	323 49.8	35.2
15	170 56.1	48 33.8	57.5	85 10.4	37.8	134 15.6	11.1	338 52.1	35.3
16	185 58.5	63 33.1	57.0	100 11.0	37.9	149 17.8	11.1	353 54.4	35.3
17	201 01.0	78 32.3	56.4	115 11.6	38.0	164 20.0	11.2	8 56.7	35.4
18	216 03.4	93 31.5	N20 55.8	130 12.2	N23 38.1	179 22.2	N13 11.3	23 59.0	S 2 35.5
19	231 05.9	108 30.7	55.2	145 12.8	38.1	194 24.4	11.3	39 01.3	35.6
20	246 08.4	123 30.0	54.6	160 13.5	38.2	209 26.6	11.4	54 03.7	35.7
21	261 10.8	138 29.2	54.1	175 14.1	38.3	224 28.9	11.5	69 06.0	35.7
22	276 13.3	153 28.4	53.5	190 14.7	38.4	239 31.1	11.6	84 08.3	35.8
23	291 15.8	168 27.7	52.9	205 15.3	38.4	254 33.3	11.6	99 10.6	35.9
29 00	306 18.2	183 26.9	N20 52.3	220 15.9	N23 38.5	269 35.5	N13 11.7	114 12.9	S 2 36.0
01	321 20.7	198 26.1	51.7	235 16.6	38.6	284 37.7	11.8	129 15.2	36.0
02	336 23.2	213 25.3	51.1	250 17.2	38.7	299 39.9	11.8	144 17.5	36.1
03	351 25.6	228 24.6	50.5	265 17.8	38.8	314 42.2	11.9	159 19.8	36.2
04	6 28.1	243 23.8	49.9	280 18.4	38.8	329 44.4	12.0	174 22.1	36.3
05	21 30.6	258 23.0	49.3	295 19.1	38.9	344 46.6	12.1	189 24.4	36.3
06	36 33.0	273 22.3	N20 48.8	310 19.7	N23 39.0	359 48.8	N13 12.1	204 26.7	S 2 36.4
07	51 35.5	288 21.5	48.2	325 20.3	39.1	14 51.0	12.2	219 29.0	36.5
08	66 37.9	303 20.7	47.6	340 20.9	39.1	29 53.3	12.3	234 31.3	36.6
F 09	81 40.4	318 20.0	47.0	355 21.5	39.2	44 55.5	12.3	249 33.6	36.7
R 10	96 42.9	333 19.2	46.4	10 22.2	39.3	59 57.7	12.4	264 35.9	36.7
I 11	111 45.3	348 18.4	45.8	25 22.8	39.4	74 59.9	12.5	279 38.2	36.8
D 12	126 47.8	3 17.7	N20 45.2	40 23.4	N23 39.4	90 02.1	N13 12.6	294 40.5	S 2 36.9
A 13	141 50.3	18 16.9	44.6	55 24.0	39.5	105 04.4	12.6	309 42.8	37.0
Y 14	156 52.7	33 16.1	44.0	70 24.6	39.6	120 06.6	12.7	324 45.1	37.0
15	171 55.2	48 15.4	43.4	85 25.3	39.7	135 08.8	12.8	339 47.4	37.1
16	186 57.7	63 14.6	42.8	100 25.9	39.7	150 11.0	12.8	354 49.7	37.2
17	202 00.1	78 13.8	42.2	115 26.5	39.8	165 13.3	12.9	9 52.0	37.3
18	217 02.6	93 13.1	N20 41.6	130 27.1	N23 39.9	180 15.5	N13 13.0	24 54.3	S 2 37.3
19	232 05.1	108 12.3	41.0	145 27.7	39.9	195 17.7	13.0	39 56.6	37.4
20	247 07.5	123 11.6	40.3	160 28.4	40.0	210 19.9	13.1	54 58.9	37.5
21	262 10.0	138 10.8	39.7	175 29.0	40.1	225 22.1	13.2	70 01.2	37.6
22	277 12.4	153 10.0	39.1	190 29.6	40.2	240 24.4	13.3	85 03.5	37.7
23	292 14.9	168 09.3	38.5	205 30.2	40.2	255 26.6	13.3	100 05.8	37.7
	h m								
Mer. Pass.	3 38.1	v −0.8	d 0.6	v 0.6	d 0.1	v 2.2	d 0.1	v 2.3	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.2
Achernar	335 27.6	S57 10.3
Acrux	173 11.2	S63 10.1
Adhara	255 13.9	S28 59.2
Aldebaran	290 51.1	N16 31.9
Alioth	166 22.0	N55 54.0
Alkaid	152 59.9	N49 15.5
Al Na'ir	27 44.9	S46 54.0
Alnilam	275 48.0	S 1 11.7
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.0	N26 40.7
Alpheratz	357 44.7	N29 09.3
Altair	62 09.2	N 8 54.1
Ankaa	353 16.7	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 56.9	N19 07.5
Atria	107 30.3	S69 03.1
Avior	234 19.2	S59 32.9
Bellatrix	278 33.7	N 6 21.6
Betelgeuse	271 03.0	N 7 24.5
Canopus	263 57.2	S52 42.0
Capella	280 36.7	N46 00.4
Deneb	49 31.9	N45 19.4
Denebola	182 35.2	N14 30.5
Diphda	348 57.1	S17 55.1
Dubhe	193 53.7	N61 41.4
Elnath	278 14.6	N28 36.9
Eltanin	90 46.3	N51 29.5
Enif	33 48.1	N 9 55.9
Fomalhaut	15 25.1	S29 33.3
Gacrux	172 02.7	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.9	S60 26.0
Hamal	328 02.3	N23 31.0
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 19.6	N74 06.8
Markab	13 39.4	N15 16.2
Menkar	314 16.5	N 4 08.2
Menkent	148 09.2	S36 25.8
Miaplacidus	221 41.0	S69 46.1
Mirfak	308 42.4	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.7	S56 41.7
Pollux	243 29.7	N27 59.8
Procyon	245 01.4	N 5 11.7
Rasalhague	96 07.4	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.6	S 8 11.2
Rigil Kent.	139 53.5	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 41.9	N56 35.9
Shaula	96 23.4	S37 06.7
Sirius	258 35.2	S16 43.9
Spica	158 32.7	S11 13.4
Suhail	222 53.9	S43 28.9
Vega	80 39.5	N38 47.9
Zuben'ubi	137 06.8	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	238 26.4	11 46
Mars	274 42.0	9 20
Jupiter	323 23.3	6 04
Saturn	167 58.4	16 24

2011 JULY 27, 28, 29 (WED., THURS., FRI.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
27 00	178 22.0	N19 20.1	229 09.0	8.6	N23 19.4	0.4	56.3
01	193 22.0	19.5	243 36.6	8.6	23 19.8	0.2	56.3
02	208 22.0	19.0	258 04.2	8.5	23 20.0	0.0	56.3
03	223 22.0	. . 18.4	272 31.7	8.5	23 20.0	0.0	56.4
04	238 22.0	17.8	286 59.2	8.4	23 20.0	0.2	56.4
05	253 22.0	17.3	301 26.6	8.4	23 19.8	0.4	56.4
06	268 22.1	N19 16.7	315 54.0	8.3	N23 19.4	0.4	56.5
W 07	283 22.1	16.2	330 21.3	8.3	23 19.0	0.6	56.5
E 08	298 22.1	15.6	344 48.6	8.3	23 18.4	0.7	56.5
D 09	313 22.1	. . 15.0	359 15.9	8.3	23 17.7	0.8	56.6
N 10	328 22.1	14.5	13 43.2	8.2	23 16.9	1.0	56.6
E 11	343 22.1	13.9	28 10.4	8.2	23 15.9	1.1	56.6
S 12	358 22.1	N19 13.3	42 37.6	8.1	N23 14.8	1.3	56.7
D 13	13 22.1	12.8	57 04.7	8.1	23 13.5	1.3	56.7
A 14	28 22.1	12.2	71 31.8	8.1	23 12.2	1.6	56.7
Y 15	43 22.1	. . 11.6	85 58.9	8.0	23 10.6	1.6	56.8
16	58 22.1	11.1	100 25.9	8.1	23 09.0	1.8	56.8
17	73 22.1	10.5	114 53.0	8.0	23 07.2	1.9	56.8
18	88 22.1	N19 09.9	129 20.0	8.0	N23 05.3	2.0	56.8
19	103 22.1	09.4	143 47.0	7.9	23 03.3	2.2	56.9
20	118 22.1	08.8	158 13.9	7.9	23 01.1	2.3	56.9
21	133 22.1	. . 08.2	172 40.8	7.9	22 58.8	2.5	56.9
22	148 22.1	07.7	187 07.7	7.9	22 56.3	2.5	57.0
23	163 22.2	07.1	201 34.6	7.9	22 53.8	2.8	57.0
28 00	178 22.2	N19 06.5	216 01.5	7.8	N22 51.0	2.8	57.0
01	193 22.2	05.9	230 28.3	7.9	22 48.2	3.0	57.1
02	208 22.2	05.4	244 55.2	7.8	22 45.2	3.1	57.1
03	223 22.2	. . 04.8	259 22.0	7.8	22 42.1	3.3	57.1
04	238 22.2	04.2	273 48.8	7.8	22 38.8	3.4	57.2
05	253 22.2	03.7	288 15.6	7.7	22 35.4	3.5	57.2
06	268 22.2	N19 03.1	302 42.3	7.8	N22 31.9	3.7	57.2
T 07	283 22.2	02.5	317 09.1	7.7	22 28.2	3.8	57.3
H 08	298 22.2	01.9	331 35.8	7.8	22 24.4	3.9	57.3
U 09	313 22.3	. . 01.4	346 02.6	7.7	22 20.5	4.1	57.3
R 10	328 22.3	00.8	0 29.3	7.7	22 16.4	4.2	57.4
S 11	343 22.3	19 00.2	14 56.0	7.8	22 12.2	4.3	57.4
D 12	358 22.3	N18 59.6	29 22.8	7.7	N22 07.9	4.5	57.4
A 13	13 22.3	59.0	43 49.5	7.7	22 03.4	4.6	57.5
Y 14	28 22.3	58.5	58 16.2	7.7	21 58.8	4.7	57.5
15	43 22.3	. . 57.9	72 42.9	7.7	21 54.1	4.9	57.5
16	58 22.3	57.3	87 09.6	7.7	21 49.2	5.0	57.6
17	73 22.3	56.7	101 36.3	7.7	21 44.2	5.2	57.6
18	88 22.4	N18 56.1	116 03.0	7.7	N21 39.0	5.3	57.6
19	103 22.4	55.6	130 29.7	7.7	21 33.7	5.4	57.7
20	118 22.4	55.0	144 56.4	7.7	21 28.3	5.5	57.7
21	133 22.4	. . 54.4	159 23.1	7.7	21 22.8	5.7	57.7
22	148 22.4	53.8	173 49.8	7.7	21 17.1	5.8	57.8
23	163 22.4	53.2	188 16.5	7.7	21 11.3	5.9	57.8
29 00	178 22.4	N18 52.6	202 43.2	7.8	N21 05.4	6.1	57.8
01	193 22.5	52.1	217 10.0	7.7	20 59.3	6.2	57.8
02	208 22.5	51.5	231 36.7	7.8	20 53.1	6.3	57.9
03	223 22.5	. . 50.9	246 03.5	7.7	20 46.8	6.5	57.9
04	238 22.5	50.3	260 30.2	7.8	20 40.3	6.6	57.9
05	253 22.5	49.7	274 57.0	7.8	20 33.7	6.7	58.0
06	268 22.5	N18 49.1	289 23.8	7.7	N20 27.0	6.9	58.0
07	283 22.6	48.5	303 50.5	7.9	20 20.1	7.0	58.0
08	298 22.6	48.0	318 17.4	7.8	20 13.1	7.1	58.1
F 09	313 22.6	. . 47.4	332 44.2	7.8	20 06.0	7.2	58.1
R 10	328 22.6	46.8	347 11.0	7.9	19 58.8	7.4	58.1
I 11	343 22.6	46.2	1 37.9	7.8	19 51.4	7.4	58.2
D 12	358 22.6	N18 45.6	16 04.7	7.9	N19 44.0	7.6	58.2
A 13	13 22.7	45.0	30 31.6	7.9	19 36.4	7.8	58.2
Y 14	28 22.7	44.4	44 58.5	7.9	19 28.6	7.8	58.2
15	43 22.7	. . 43.8	59 25.4	8.0	19 20.8	8.0	58.3
16	58 22.7	43.2	73 52.4	7.9	19 12.8	8.1	58.3
17	73 22.7	42.6	88 19.3	8.0	19 04.7	8.2	58.3
18	88 22.7	N18 42.0	102 46.3	8.0	N18 56.5	8.4	58.4
19	103 22.8	41.4	117 13.3	8.1	18 48.1	8.5	58.4
20	118 22.8	40.8	131 40.4	8.0	18 39.6	8.5	58.4
21	133 22.8	. . 40.3	146 07.4	8.1	18 31.1	8.7	58.5
22	148 22.8	39.7	160 34.5	8.1	18 22.4	8.9	58.5
23	163 22.8	39.1	175 01.6	8.1	N18 13.5	8.9	58.5
	SD 15.8	d 0.6	SD 15.4		15.6		15.9

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 27	Moonrise 28	Moonrise 29	Moonrise 30
°	h m	h m	h m	h m	h m	h m	h m
N 72							
N 70	////	////	00 25				01 19
68	////	////	01 51		23 42	25 59	01 59
66	////	////	02 28	22 51	24 34	00 34	02 26
64	////	01 10	02 54	23 38	25 06	01 06	02 47
62	////	01 57	03 14	24 09	00 09	01 30	03 04
60	////	02 26	03 30	24 31	00 31	01 49	03 18
N 58	01 03	02 48	03 44	24 50	00 50	02 05	03 30
56	01 46	03 05	03 56	00 06	01 05	02 18	03 40
54	02 13	03 20	04 06	00 20	01 19	02 29	03 49
52	02 34	03 33	04 15	00 32	01 30	02 40	03 57
50	02 51	03 44	04 23	00 42	01 41	02 49	04 04
45	03 22	04 06	04 40	01 04	02 02	03 08	04 19
N 40	03 45	04 24	04 54	01 22	02 19	03 23	04 32
35	04 04	04 38	05 06	01 37	02 34	03 36	04 43
30	04 19	04 50	05 16	01 50	02 47	03 48	04 52
20	04 42	05 10	05 34	02 13	03 08	04 07	05 08
N 10	05 00	05 27	05 49	02 32	03 27	04 24	05 22
0	05 16	05 41	06 03	02 50	03 45	04 40	05 35
S 10	05 29	05 55	06 17	03 08	04 02	04 56	05 48
20	05 42	06 08	06 32	03 28	04 21	05 13	06 02
30	05 54	06 23	06 48	03 50	04 43	05 32	06 17
35	06 00	06 31	06 58	04 03	04 55	05 43	06 27
40	06 07	06 40	07 09	04 18	05 10	05 56	06 37
45	06 14	06 50	07 22	04 36	05 27	06 11	06 49
S 50	06 22	07 02	07 38	04 59	05 48	06 30	07 04
52	06 26	07 07	07 45	05 10	05 58	06 38	07 11
54	06 30	07 13	07 53	05 22	06 10	06 48	07 18
56	06 34	07 20	08 02	05 36	06 23	06 59	07 27
58	06 38	07 27	08 13	05 52	06 38	07 12	07 36
S 60	06 43	07 35	08 25	06 12	06 56	07 26	07 47

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 27	Moonset 28	Moonset 29	Moonset 30
°	h m	h m	h m	h m	h m	h m	h m
N 72							21 35
N 70	23 26	////	////			21 38	21 07
68	22 17	////	////		21 19	20 57	20 45
66	21 42	////	////	20 13	20 26	20 28	20 28
64	21 16	22 56	////	19 26	19 53	20 07	20 14
62	20 57	22 13	////	18 56	19 29	19 49	20 02
60	20 41	21 44	////	18 32	19 09	19 35	19 52
N 58	20 28	21 23	23 03	18 14	18 53	19 22	19 43
56	20 16	21 06	22 23	17 58	18 40	19 11	19 36
54	20 06	20 52	21 57	17 45	18 28	19 02	19 29
52	19 57	20 39	21 37	17 33	18 17	18 53	19 22
50	19 49	20 28	21 21	17 23	18 08	18 46	19 17
45	19 32	20 06	20 50	17 01	17 48	18 29	19 04
N 40	19 18	19 49	20 27	16 43	17 32	18 15	18 54
35	19 07	19 35	20 09	16 28	17 18	18 04	18 45
30	18 56	19 22	19 54	16 15	17 06	17 54	18 37
20	18 39	19 03	19 31	15 53	16 46	17 36	18 24
N 10	18 24	18 46	19 12	15 34	16 28	17 21	18 12
0	18 10	18 32	18 57	15 16	16 11	17 06	18 01
S 10	17 56	18 18	18 44	14 58	15 54	16 52	17 49
20	17 42	18 05	18 32	14 39	15 36	16 36	17 37
30	17 25	17 50	18 19	14 17	15 15	16 18	17 23
35	17 15	17 42	18 13	14 03	15 03	16 08	17 15
40	17 04	17 33	18 06	13 48	14 49	15 55	17 06
45	16 51	17 23	17 59	13 30	14 32	15 41	16 55
S 50	16 36	17 12	17 51	13 08	14 11	15 24	16 41
52	16 29	17 06	17 48	12 57	14 01	15 15	16 35
54	16 20	17 00	17 44	12 45	13 50	15 06	16 28
56	16 11	16 54	17 40	12 31	13 38	14 55	16 20
58	16 01	16 47	17 36	12 15	13 23	14 43	16 11
S 60	15 49	16 39	17 31	11 55	13 05	14 29	16 01

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
27	06 32	06 32	12 07	09 03	21 30	26	12
28	06 31	06 31	12 07	09 58	22 26	27	6
29	06 30	06 29	12 06	10 53	23 21	28	2

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.4		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
30 00	307 17.4	183 08.5	N20 37.9	220 30.9	N23 40.3	270 28.8	N13 13.4	115 08.2	S 2 37.8
01	322 19.8	198 07.7	37.3	235 31.5	40.4	285 31.0	13.5	130 10.5	37.9
02	337 22.3	213 07.0	36.7	250 32.1	40.4	300 33.3	13.5	145 12.8	38.0
03	352 24.8	228 06.2	36.1	265 32.7	40.5	315 35.5	13.6	160 15.1	38.0
04	7 27.2	243 05.5	35.5	280 33.3	40.6	330 37.7	13.7	175 17.4	38.1
05	22 29.7	258 04.7	34.8	295 34.0	40.6	345 39.9	13.7	190 19.7	38.2
06	37 32.2	273 03.9	N20 34.2	310 34.6	N23 40.7	0 42.2	N13 13.8	205 22.0	S 2 38.3
07	52 34.6	288 03.2	33.6	325 35.2	40.8	15 44.4	13.9	220 24.3	38.4
S 08	67 37.1	303 02.4	33.0	340 35.8	40.8	30 46.6	13.9	235 26.6	38.4
A 09	82 39.6	318 01.7	32.4	355 36.5	40.9	45 48.9	14.0	250 28.9	38.5
T 10	97 42.0	333 00.9	31.7	10 37.1	41.0	60 51.1	14.1	265 31.2	38.6
U 11	112 44.5	348 00.2	31.1	25 37.7	41.0	75 53.3	14.2	280 33.5	38.7
R 12	127 46.9	2 59.4	N20 30.5	40 38.3	N23 41.1	90 55.5	N13 14.2	295 35.8	S 2 38.7
D 13	142 49.4	17 58.6	29.9	55 39.0	41.2	105 57.8	14.3	310 38.1	38.8
A 14	157 51.9	32 57.9	29.2	70 39.6	41.2	121 00.0	14.4	325 40.4	38.9
Y 15	172 54.3	47 57.1	28.6	85 40.2	41.3	136 02.2	14.4	340 42.7	39.0
16	187 56.8	62 56.4	28.0	100 40.8	41.4	151 04.4	14.5	355 45.0	39.1
17	202 59.3	77 55.6	27.4	115 41.5	41.4	166 06.7	14.6	10 47.3	39.1
18	218 01.7	92 54.9	N20 26.7	130 42.1	N23 41.5	181 08.9	N13 14.6	25 49.6	S 2 39.2
19	233 04.2	107 54.1	26.1	145 42.7	41.5	196 11.1	14.7	40 51.9	39.3
20	248 06.7	122 53.4	25.5	160 43.3	41.6	211 13.4	14.8	55 54.2	39.4
21	263 09.1	137 52.6	24.8	175 43.9	41.7	226 15.6	14.8	70 56.5	39.5
22	278 11.6	152 51.9	24.2	190 44.6	41.7	241 17.8	14.9	85 58.8	39.5
23	293 14.0	167 51.1	23.6	205 45.2	41.8	256 20.1	15.0	101 01.1	39.6
31 00	308 16.5	182 50.4	N20 22.9	220 45.8	N23 41.9	271 22.3	N13 15.0	116 03.4	S 2 39.7
01	323 19.0	197 49.6	22.3	235 46.4	41.9	286 24.5	15.1	131 05.7	39.8
02	338 21.4	212 48.9	21.7	250 47.1	42.0	301 26.8	15.2	146 08.0	39.9
03	353 23.9	227 48.1	21.0	265 47.7	42.0	316 29.0	15.2	161 10.3	39.9
04	8 26.4	242 47.4	20.4	280 48.3	42.1	331 31.2	15.3	176 12.6	40.0
05	23 28.8	257 46.6	19.7	295 48.9	42.2	346 33.5	15.4	191 14.8	40.1
06	38 31.3	272 45.9	N20 19.1	310 49.6	N23 42.2	1 35.7	N13 15.4	206 17.1	S 2 40.2
07	53 33.8	287 45.1	18.4	325 50.2	42.3	16 37.9	15.5	221 19.4	40.2
08	68 36.2	302 44.4	17.8	340 50.8	42.3	31 40.1	15.6	236 21.7	40.3
S 09	83 38.7	317 43.6	17.2	355 51.4	42.4	46 42.4	15.6	251 24.0	40.4
U 10	98 41.2	332 42.9	16.5	10 52.1	42.4	61 44.6	15.7	266 26.3	40.5
N 11	113 43.6	347 42.1	15.9	25 52.7	42.5	76 46.9	15.8	281 28.6	40.6
D 12	128 46.1	2 41.4	N20 15.2	40 53.3	N23 42.6	91 49.1	N13 15.8	296 30.9	S 2 40.6
A 13	143 48.5	17 40.6	14.6	55 54.0	42.6	106 51.3	15.9	311 33.2	40.7
Y 14	158 51.0	32 39.9	13.9	70 54.6	42.7	121 53.6	16.0	326 35.5	40.8
15	173 53.5	47 39.1	13.3	85 55.2	42.7	136 55.8	16.0	341 37.8	40.9
16	188 55.9	62 38.4	12.6	100 55.8	42.8	151 58.0	16.1	356 40.1	41.0
17	203 58.4	77 37.6	12.0	115 56.5	42.8	167 00.3	16.2	11 42.4	41.0
18	219 00.9	92 36.9	N20 11.3	130 57.1	N23 42.9	182 02.5	N13 16.2	26 44.7	S 2 41.1
19	234 03.3	107 36.2	10.7	145 57.7	42.9	197 04.7	16.3	41 47.0	41.2
20	249 05.8	122 35.4	10.0	160 58.3	43.0	212 07.0	16.4	56 49.3	41.3
21	264 08.3	137 34.7	09.3	175 59.0	43.1	227 09.2	16.4	71 51.6	41.4
22	279 10.7	152 33.9	08.7	190 59.6	43.1	242 11.4	16.5	86 53.9	41.4
23	294 13.2	167 33.2	08.0	206 00.2	43.2	257 13.7	16.6	101 56.2	41.5
1 00	309 15.7	182 32.5	N20 07.4	221 00.8	N23 43.2	272 15.9	N13 16.6	116 58.5	S 2 41.6
01	324 18.1	197 31.7	06.7	236 01.5	43.3	287 18.2	16.7	132 00.8	41.7
02	339 20.6	212 31.0	06.0	251 02.1	43.3	302 20.4	16.7	147 03.1	41.8
03	354 23.0	227 30.2	05.4	266 02.7	43.4	317 22.6	16.8	162 05.4	41.8
04	9 25.5	242 29.5	04.7	281 03.4	43.4	332 24.9	16.9	177 07.7	41.9
05	24 28.0	257 28.8	04.0	296 04.0	43.5	347 27.1	16.9	192 10.0	42.0
06	39 30.4	272 28.0	N20 03.4	311 04.6	N23 43.5	2 29.4	N13 17.0	207 12.3	S 2 42.1
07	54 32.9	287 27.3	02.7	326 05.2	43.6	17 31.6	17.1	222 14.6	42.2
08	69 35.4	302 26.5	02.0	341 05.9	43.6	32 33.8	17.1	237 16.9	42.2
M 09	84 37.8	317 25.8	01.4	356 06.5	43.7	47 36.1	17.2	252 19.1	42.3
O 10	99 40.3	332 25.1	00.7	11 07.1	43.7	62 38.3	17.3	267 21.4	42.4
N 11	114 42.8	347 24.3	20 00.0	26 07.7	43.8	77 40.6	17.3	282 23.7	42.5
D 12	129 45.2	2 23.6	N19 59.4	41 08.4	N23 43.8	92 42.8	N13 17.4	297 26.0	S 2 42.6
A 13	144 47.7	17 22.9	58.7	56 09.0	43.9	107 45.0	17.5	312 28.3	42.6
Y 14	159 50.1	32 22.1	58.0	71 09.6	43.9	122 47.3	17.5	327 30.6	42.7
15	174 52.6	47 21.4	57.3	86 10.3	44.0	137 49.5	17.6	342 32.9	42.8
16	189 55.1	62 20.6	56.7	101 10.9	44.0	152 51.8	17.6	357 35.2	42.9
17	204 57.5	77 19.9	56.0	116 11.5	44.0	167 54.0	17.7	12 37.5	43.0
18	220 00.0	92 19.2	N19 55.3	131 12.1	N23 44.1	182 56.3	N13 17.8	27 39.8	S 2 43.0
19	235 02.5	107 18.4	54.6	146 12.8	44.1	197 58.5	17.8	42 42.1	43.1
20	250 04.9	122 17.7	53.9	161 13.4	44.2	213 00.7	17.9	57 44.4	43.2
21	265 07.4	137 17.0	53.3	176 14.0	44.2	228 03.0	18.0	72 46.7	43.3
22	280 09.9	152 16.3	52.6	191 14.7	44.3	243 05.2	18.0	87 49.0	43.4
23	295 12.3	167 15.5	51.9	206 15.3	44.3	258 07.5	18.1	102 51.3	43.5
	h m								
Mer. Pass.	3 26.3	*v* −0.7	*d* 0.6	*v* 0.6	*d* 0.1	*v* 2.2	*d* 0.1	*v* 2.3	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.4	S40 15.2
Achernar	335 27.6	S57 10.3
Acrux	173 11.2	S63 10.1
Adhara	255 13.9	S28 59.2
Aldebaran	290 51.1	N16 31.9
Alioth	166 22.0	N55 54.0
Alkaid	152 59.9	N49 15.5
Al Na'ir	27 44.9	S46 54.0
Alnilam	275 47.9	S 1 11.6
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.0	N26 40.7
Alpheratz	357 44.7	N29 09.3
Altair	62 09.2	N 8 54.1
Ankaa	353 16.7	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 56.9	N19 07.5
Atria	107 30.4	S69 03.1
Avior	234 19.2	S59 32.9
Bellatrix	278 33.6	N 6 21.6
Betelgeuse	271 03.0	N 7 24.5
Canopus	263 57.2	S52 42.0
Capella	280 36.7	N46 00.4
Deneb	49 31.9	N45 19.5
Denebola	182 35.2	N14 30.5
Diphda	348 57.0	S17 55.1
Dubhe	193 53.7	N61 41.4
Elnath	278 14.5	N28 36.9
Eltanin	90 46.3	N51 29.5
Enif	33 48.1	N 9 55.9
Fomalhaut	15 25.1	S29 33.3
Gacrux	172 02.7	S57 11.0
Gienah	175 53.8	S17 36.5
Hadar	148 49.9	S60 26.0
Hamal	328 02.2	N23 31.0
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 19.7	N74 06.8
Markab	13 39.4	N15 16.2
Menkar	314 16.5	N 4 08.2
Menkent	148 09.2	S36 25.8
Miaplacidus	221 41.0	S69 46.0
Mirfak	308 42.4	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.6	S56 41.7
Pollux	243 29.7	N27 59.8
Procyon	245 01.4	N 5 11.7
Rasalhague	96 07.4	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.5	S 8 11.2
Rigil Kent.	139 53.5	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 41.8	N56 36.0
Shaula	96 23.4	S37 06.7
Sirius	258 35.2	S16 43.9
Spica	158 32.7	S11 13.4
Suhail	222 53.9	S43 28.9
Vega	80 39.5	N38 47.9
Zuben'ubi	137 06.8	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	234 33.8	11 49
Mars	272 29.3	9 17
Jupiter	323 05.8	5 54
Saturn	167 46.8	16 13

UT	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise			
									Naut.	Civil		30	31	1	2
	GHA	Dec	GHA	v	Dec	d	HP								
d h	° ′	° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
								N 72	▭	▭	▭	▭	03 17	05 41	07 54
30 00	178 22.9	N18 38.5	189 28.7	8.1	N18 04.6	9.0	58.5	N 70	////	////	01 13	01 19	03 43	05 52	07 56
01	193 22.9	37.9	203 55.8	8.2	17 55.6	9.2	58.6	68	////	////	02 08	01 59	04 03	06 02	07 58
02	208 22.9	37.3	218 23.0	8.2	17 46.4	9.3	58.6	66	////	////	02 40	02 26	04 19	06 10	07 59
03	223 22.9	. . 36.7	232 50.2	8.2	17 37.1	9.4	58.6	64	////	01 31	03 04	02 47	04 32	06 16	08 00
04	238 23.0	36.1	247 17.4	8.3	17 27.7	9.5	58.6	62	////	02 09	03 22	03 04	04 42	06 22	08 01
05	253 23.0	35.5	261 44.7	8.3	17 18.2	9.6	58.7	60	////	02 36	03 37	03 18	04 51	06 27	08 02
06	268 23.0	N18 34.9	276 12.0	8.3	N17 08.6	9.7	58.7	N 58	01 23	02 56	03 50	03 30	04 59	06 31	08 03
07	283 23.0	34.3	290 39.3	8.3	16 58.9	9.9	58.7	56	01 58	03 12	04 01	03 40	05 06	06 35	08 04
S 08	298 23.0	33.7	305 06.6	8.4	16 49.0	9.9	58.8	54	02 22	03 26	04 11	03 49	05 13	06 38	08 04
A 09	313 23.1	. . 33.1	319 34.0	8.4	16 39.1	10.1	58.8	52	02 41	03 38	04 20	03 57	05 18	06 41	08 05
T 10	328 23.1	32.5	334 01.4	8.4	16 29.0	10.1	58.8	50	02 57	03 48	04 27	04 04	05 23	06 44	08 05
U 11	343 23.1	31.9	348 28.8	8.5	16 18.9	10.3	58.8	45	03 27	04 10	04 44	04 19	05 34	06 50	08 06
R 12	358 23.1	N18 31.3	2 56.3	8.4	N16 08.6	10.3	58.9	N 40	03 49	04 27	04 57	04 32	05 43	06 55	08 07
D 13	13 23.2	30.7	17 23.7	8.6	15 58.3	10.5	58.9	35	04 06	04 40	05 08	04 43	05 51	06 59	08 08
A 14	28 23.2	30.0	31 51.3	8.5	15 47.8	10.6	58.9	30	04 21	04 52	05 18	04 52	05 57	07 03	08 09
Y 15	43 23.2	. . 29.4	46 18.8	8.6	15 37.2	10.7	58.9	20	04 44	05 11	05 35	05 08	06 09	07 10	08 10
16	58 23.2	28.8	60 46.4	8.6	15 26.5	10.7	59.0	N 10	05 01	05 27	05 49	05 22	06 19	07 16	08 11
17	73 23.3	28.2	75 14.0	8.6	15 15.8	10.9	59.0	0	05 16	05 41	06 03	05 35	06 29	07 21	08 13
18	88 23.3	N18 27.6	89 41.6	8.7	N15 04.9	11.0	59.0	S 10	05 29	05 54	06 16	05 48	06 38	07 26	08 14
19	103 23.3	27.0	104 09.3	8.7	14 53.9	11.0	59.0	20	05 41	06 07	06 30	06 02	06 48	07 32	08 15
20	118 23.3	26.4	118 37.0	8.7	14 42.9	11.2	59.1	30	05 52	06 21	06 46	06 17	06 59	07 39	08 16
21	133 23.4	. . 25.8	133 04.7	8.8	14 31.7	11.2	59.1	35	05 58	06 29	06 56	06 27	07 06	07 42	08 17
22	148 23.4	25.2	147 32.5	8.8	14 20.5	11.4	59.1	40	06 05	06 37	07 06	06 37	07 13	07 47	08 18
23	163 23.4	24.6	162 00.3	8.8	14 09.1	11.4	59.1	45	06 11	06 47	07 19	06 49	07 22	07 51	08 19
31 00	178 23.4	N18 24.0	176 28.1	8.8	N13 57.7	11.5	59.2	S 50	06 19	06 58	07 33	07 04	07 32	07 57	08 20
01	193 23.5	23.4	190 55.9	8.9	13 46.2	11.7	59.2	52	06 22	07 03	07 40	07 11	07 37	08 00	08 21
02	208 23.5	22.8	205 23.8	8.9	13 34.5	11.7	59.2	54	06 26	07 09	07 48	07 18	07 42	08 03	08 21
03	223 23.5	. . 22.1	219 51.7	9.0	13 22.8	11.7	59.2	56	06 29	07 15	07 57	07 27	07 48	08 06	08 22
04	238 23.6	21.5	234 19.7	8.9	13 11.1	11.9	59.2	58	06 33	07 22	08 07	07 36	07 55	08 10	08 23
05	253 23.6	20.9	248 47.6	9.1	12 59.2	12.0	59.3	S 60	06 38	07 29	08 18	07 47	08 02	08 14	08 24
06	268 23.6	N18 20.3	263 15.7	9.0	N12 47.2	12.0	59.3								
07	283 23.6	19.7	277 43.7	9.1	12 35.2	12.1	59.3								
08	298 23.7	19.1	292 11.8	9.1	12 23.1	12.2	59.3								
S 09	313 23.7	. . 18.5	306 39.9	9.1	12 10.9	12.3	59.3								
U 10	328 23.7	17.8	321 08.0	9.2	11 58.6	12.4	59.4								
N 11	343 23.8	17.2	335 36.2	9.1	11 46.2	12.4	59.4								
D 12	358 23.8	N18 16.6	350 04.3	9.3	N11 33.8	12.5	59.4								
A 13	13 23.8	16.0	4 32.6	9.2	11 21.3	12.6	59.4								
Y 14	28 23.9	15.4	19 00.8	9.3	11 08.7	12.6	59.4								
15	43 23.9	. . 14.8	33 29.1	9.3	10 56.1	12.7	59.5								
16	58 23.9	14.1	47 57.4	9.3	10 43.4	12.8	59.5								
17	73 23.9	13.5	62 25.7	9.4	10 30.6	12.9	59.5								
18	88 24.0	N18 12.9	76 54.1	9.4	N10 17.7	12.9	59.5								
19	103 24.0	12.3	91 22.5	9.4	10 04.8	13.0	59.5								
20	118 24.0	11.7	105 50.9	9.4	9 51.8	13.1	59.5								
21	133 24.1	. . 11.0	120 19.3	9.5	9 38.7	13.1	59.6								
22	148 24.1	10.4	134 47.8	9.5	9 25.6	13.1	59.6								
23	163 24.1	09.8	149 16.3	9.5	9 12.5	13.3	59.6								
1 00	178 24.2	N18 09.2	163 44.8	9.6	N 8 59.2	13.3	59.6								
01	193 24.2	08.6	178 13.4	9.6	8 45.9	13.3	59.6								
02	208 24.2	07.9	192 42.0	9.6	8 32.6	13.4	59.6								
03	223 24.3	. . 07.3	207 10.6	9.6	8 19.2	13.5	59.7								
04	238 24.3	06.7	221 39.2	9.6	8 05.7	13.5	59.7								
05	253 24.3	06.1	236 07.8	9.7	7 52.2	13.5	59.7								
06	268 24.4	N18 05.4	250 36.5	9.7	N 7 38.7	13.6	59.7								
07	283 24.4	04.8	265 05.2	9.7	7 25.1	13.7	59.7								
08	298 24.5	04.2	279 33.9	9.7	7 11.4	13.7	59.7								
M 09	313 24.5	. . 03.6	294 02.6	9.8	6 57.7	13.7	59.7								
O 10	328 24.5	02.9	308 31.4	9.7	6 44.0	13.8	59.7								
N 11	343 24.6	02.3	323 00.1	9.8	6 30.2	13.9	59.8								
D 12	358 24.6	N18 01.7	337 28.9	9.8	N 6 16.3	13.8	59.8								
A 13	13 24.6	01.0	351 57.7	9.9	6 02.5	13.9	59.8								
Y 14	28 24.7	18 00.4	6 26.6	9.8	5 48.6	14.0	59.8								
15	43 24.7	17 59.8	20 55.4	9.9	5 34.6	14.0	59.8								
16	58 24.7	59.2	35 24.3	9.9	5 20.6	14.0	59.8								
17	73 24.8	58.5	49 53.2	9.9	5 06.6	14.0	59.8								
18	88 24.8	N17 57.9	64 22.1	9.9	N 4 52.6	14.1	59.8								
19	103 24.9	57.3	78 51.0	9.9	4 38.5	14.1	59.8								
20	118 24.9	56.6	93 19.9	9.9	4 24.4	14.1	59.8								
21	133 24.9	. . 56.0	107 48.8	10.0	4 10.3	14.2	59.9								
22	148 25.0	55.4	122 17.8	10.0	3 56.1	14.2	59.9								
23	163 25.0	54.7	136 46.8	9.9	N 3 41.9	14.2	59.9								
	SD 15.8	d 0.6	SD	16.0		16.2									16.3

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	30	31	1	2
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	21 35	21 02	20 39	20 18
N 70	22 51	////	////	21 07	20 48	20 33	20 20
68	22 01	////	////	20 45	20 37	20 29	20 21
66	21 30	////	////	20 28	20 27	20 25	20 23
64	21 07	22 36	////	20 14	20 19	20 22	20 24
62	20 49	22 00	////	20 02	20 12	20 19	20 25
60	20 34	21 35	////	19 52	20 05	20 16	20 26
N 58	20 21	21 15	22 45	19 43	20 00	20 14	20 27
56	20 10	20 59	22 12	19 36	19 55	20 12	20 28
54	20 01	20 45	21 48	19 29	19 51	20 10	20 28
52	19 52	20 34	21 30	19 22	19 47	20 08	20 29
50	19 45	20 23	21 15	19 17	19 43	20 07	20 29
45	19 28	20 02	20 45	19 04	19 35	20 04	20 31
N 40	19 15	19 46	20 23	18 54	19 29	20 01	20 32
35	19 04	19 32	20 06	18 45	19 23	19 58	20 33
30	18 54	19 20	19 51	18 37	19 18	19 56	20 33
20	18 38	19 01	19 29	18 24	19 09	19 52	20 35
N 10	18 23	18 45	19 11	18 12	19 01	19 49	20 36
0	18 10	18 32	18 57	18 01	18 54	19 46	20 37
S 10	17 57	18 19	18 44	17 49	18 46	19 42	20 38
20	17 43	18 06	18 32	17 37	18 38	19 39	20 39
30	17 27	17 52	18 21	17 23	18 29	19 35	20 40
35	17 17	17 44	18 15	17 15	18 23	19 32	20 41
40	17 07	17 36	18 09	17 06	18 17	19 30	20 42
45	16 55	17 26	18 02	16 55	18 10	19 26	20 43
S 50	16 40	17 15	17 55	16 41	18 01	19 23	20 44
52	16 33	17 10	17 51	16 35	17 57	19 21	20 44
54	16 25	17 05	17 48	16 28	17 53	19 19	20 45
56	16 17	16 59	17 44	16 20	17 48	19 17	20 46
58	16 07	16 52	17 40	16 11	17 42	19 14	20 46
S 60	15 56	16 44	17 36	16 01	17 36	19 12	20 47

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00h	12h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
30	06 29	06 27	12 06	11 48	24 15	29	0
31	06 26	06 25	12 06	12 41	00 15	01	1
1	06 23	06 22	12 06	13 33	01 07	02	4

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.5		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
2 00	310 14.8	182 14.8	N19 51.2	221 15.9	N23 44.4	273 09.7	N13 18.1	117 53.6	S 2 43.5
01	325 17.3	197 14.1	50.5	236 16.6	44.4	288 12.0	18.2	132 55.8	43.6
02	340 19.7	212 13.3	49.8	251 17.2	44.4	303 14.2	18.3	147 58.1	43.7
03	355 22.2	227 12.6	49.2	266 17.8	44.5	318 16.5	18.3	163 00.4	43.8
04	10 24.6	242 11.9	48.5	281 18.4	44.5	333 18.7	18.4	178 02.7	43.9
05	25 27.1	257 11.1	47.8	296 19.1	44.6	348 20.9	18.5	193 05.0	43.9
06	40 29.6	272 10.4	N19 47.1	311 19.7	N23 44.6	3 23.2	N13 18.5	208 07.3	S 2 44.0
07	55 32.0	287 09.7	46.4	326 20.3	44.7	18 25.4	18.6	223 09.6	44.1
08	70 34.5	302 09.0	45.7	341 21.0	44.7	33 27.7	18.6	238 11.9	44.2
T 09	85 37.0	317 08.2	45.0	356 21.6	44.7	48 29.9	18.7	253 14.2	44.3
U 10	100 39.4	332 07.5	44.3	11 22.2	44.8	63 32.2	18.8	268 16.5	44.3
E 11	115 41.9	347 06.8	43.6	26 22.9	44.8	78 34.4	18.8	283 18.8	44.4
S 12	130 44.4	2 06.1	N19 42.9	41 23.5	N23 44.9	93 36.7	N13 18.9	298 21.1	S 2 44.5
D 13	145 46.8	17 05.3	42.2	56 24.1	44.9	108 38.9	18.9	313 23.3	44.6
A 14	160 49.3	32 04.6	41.5	71 24.8	44.9	123 41.2	19.0	328 25.6	44.7
Y 15	175 51.7	47 03.9	40.8	86 25.4	45.0	138 43.4	19.1	343 27.9	44.8
16	190 54.2	62 03.2	40.1	101 26.0	45.0	153 45.7	19.1	358 30.2	44.8
17	205 56.7	77 02.4	39.4	116 26.6	45.1	168 47.9	19.2	13 32.5	44.9
18	220 59.1	92 01.7	N19 38.7	131 27.3	N23 45.1	183 50.2	N13 19.2	28 34.8	S 2 45.0
19	236 01.6	107 01.0	38.0	146 27.9	45.1	198 52.4	19.3	43 37.1	45.1
20	251 04.1	122 00.3	37.3	161 28.5	45.2	213 54.7	19.4	58 39.4	45.2
21	266 06.5	136 59.5	36.6	176 29.2	45.2	228 56.9	19.4	73 41.7	45.2
22	281 09.0	151 58.8	35.9	191 29.8	45.2	243 59.2	19.5	88 44.0	45.3
23	296 11.5	166 58.1	35.2	206 30.4	45.3	259 01.4	19.5	103 46.3	45.4
3 00	311 13.9	181 57.4	N19 34.5	221 31.1	N23 45.3	274 03.7	N13 19.6	118 48.5	S 2 45.5
01	326 16.4	196 56.7	33.8	236 31.7	45.3	289 05.9	19.7	133 50.8	45.6
02	341 18.9	211 55.9	33.1	251 32.3	45.4	304 08.2	19.7	148 53.1	45.7
03	356 21.3	226 55.2	32.4	266 33.0	45.4	319 10.4	19.8	163 55.4	45.7
04	11 23.8	241 54.5	31.7	281 33.6	45.4	334 12.7	19.8	178 57.7	45.8
05	26 26.2	256 53.8	31.0	296 34.2	45.5	349 14.9	19.9	194 00.0	45.9
06	41 28.7	271 53.1	N19 30.2	311 34.9	N23 45.5	4 17.2	N13 20.0	209 02.3	S 2 46.0
W 07	56 31.2	286 52.4	29.5	326 35.5	45.5	19 19.4	20.0	224 04.6	46.1
E 08	71 33.6	301 51.6	28.8	341 36.1	45.6	34 21.7	20.1	239 06.9	46.2
D 09	86 36.1	316 50.9	28.1	356 36.8	45.6	49 24.0	20.1	254 09.2	46.2
N 10	101 38.6	331 50.2	27.4	11 37.4	45.6	64 26.2	20.2	269 11.4	46.3
E 11	116 41.0	346 49.5	26.7	26 38.0	45.7	79 28.5	20.3	284 13.7	46.4
S 12	131 43.5	1 48.8	N19 25.9	41 38.7	N23 45.7	94 30.7	N13 20.3	299 16.0	S 2 46.5
D 13	146 46.0	16 48.1	25.2	56 39.3	45.7	109 33.0	20.4	314 18.3	46.6
A 14	161 48.4	31 47.4	24.5	71 39.9	45.8	124 35.2	20.4	329 20.6	46.6
Y 15	176 50.9	46 46.6	23.8	86 40.6	45.8	139 37.5	20.5	344 22.9	46.7
16	191 53.4	61 45.9	23.1	101 41.2	45.8	154 39.7	20.6	359 25.2	46.8
17	206 55.8	76 45.2	22.3	116 41.8	45.9	169 42.0	20.6	14 27.5	46.9
18	221 58.3	91 44.5	N19 21.6	131 42.5	N23 45.9	184 44.3	N13 20.7	29 29.7	S 2 47.0
19	237 00.7	106 43.8	20.9	146 43.1	45.9	199 46.5	20.7	44 32.0	47.1
20	252 03.2	121 43.1	20.2	161 43.7	45.9	214 48.8	20.8	59 34.3	47.1
21	267 05.7	136 42.4	19.4	176 44.4	46.0	229 51.0	20.8	74 36.6	47.2
22	282 08.1	151 41.7	18.7	191 45.0	46.0	244 53.3	20.9	89 38.9	47.3
23	297 10.6	166 40.9	18.0	206 45.6	46.0	259 55.5	21.0	104 41.2	47.4
4 00	312 13.1	181 40.2	N19 17.2	221 46.3	N23 46.0	274 57.8	N13 21.0	119 43.5	S 2 47.5
01	327 15.5	196 39.5	16.5	236 46.9	46.1	290 00.1	21.1	134 45.8	47.6
02	342 18.0	211 38.8	15.8	251 47.5	46.1	305 02.3	21.1	149 48.0	47.6
03	357 20.5	226 38.1	15.0	266 48.2	46.1	320 04.6	21.2	164 50.3	47.7
04	12 22.9	241 37.4	14.3	281 48.8	46.2	335 06.8	21.2	179 52.6	47.8
05	27 25.4	256 36.7	13.6	296 49.5	46.2	350 09.1	21.3	194 54.9	47.9
06	42 27.8	271 36.0	N19 12.8	311 50.1	N23 46.2	5 11.4	N13 21.4	209 57.2	S 2 48.0
07	57 30.3	286 35.3	12.1	326 50.7	46.2	20 13.6	21.4	224 59.5	48.1
T 08	72 32.8	301 34.6	11.4	341 51.4	46.3	35 15.9	21.5	240 01.8	48.1
H 09	87 35.2	316 33.9	10.6	356 52.0	46.3	50 18.1	21.5	255 04.0	48.2
U 10	102 37.7	331 33.2	09.9	11 52.6	46.3	65 20.4	21.6	270 06.3	48.3
R 11	117 40.2	346 32.5	09.1	26 53.3	46.3	80 22.7	21.6	285 08.6	48.4
S 12	132 42.6	1 31.8	N19 08.4	41 53.9	N23 46.3	95 24.9	N13 21.7	300 10.9	S 2 48.5
D 13	147 45.1	16 31.1	07.6	56 54.5	46.4	110 27.2	21.8	315 13.2	48.6
A 14	162 47.6	31 30.4	06.9	71 55.2	46.4	125 29.5	21.8	330 15.5	48.6
Y 15	177 50.0	46 29.7	06.2	86 55.8	46.4	140 31.7	21.9	345 17.8	48.7
16	192 52.5	61 29.0	05.4	101 56.5	46.4	155 34.0	21.9	0 20.0	48.8
17	207 55.0	76 28.3	04.7	116 57.1	46.5	170 36.2	22.0	15 22.3	48.9
18	222 57.4	91 27.6	N19 03.9	131 57.7	N23 46.5	185 38.5	N13 22.0	30 24.6	S 2 49.0
19	237 59.9	106 26.9	03.2	146 58.4	46.5	200 40.8	22.1	45 26.9	49.1
20	253 02.3	121 26.2	02.4	161 59.0	46.5	215 43.0	22.2	60 29.2	49.2
21	268 04.8	136 25.5	01.7	176 59.6	46.5	230 45.3	22.2	75 31.5	49.2
22	283 07.3	151 24.8	00.9	192 00.3	46.6	245 47.6	22.3	90 33.8	49.3
23	298 09.7	166 24.1	00.2	207 00.9	46.6	260 49.8	22.3	105 36.0	49.4
	h m								
Mer. Pass.	3 14.5	*v* −0.7	*d* 0.7	*v* 0.6	*d* 0.0	*v* 2.3	*d* 0.1	*v* 2.3	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.3	S40 15.2
Achernar	335 27.5	S57 10.3
Acrux	173 11.2	S63 10.1
Adhara	255 13.9	S28 59.2
Aldebaran	290 51.1	N16 31.9
Alioth	166 22.0	N55 54.0
Alkaid	153 00.0	N49 15.5
Al Na'ir	27 44.9	S46 54.0
Alnilam	275 47.9	S 1 11.6
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.0	N26 40.7
Alpheratz	357 44.7	N29 09.3
Altair	62 09.2	N 8 54.2
Ankaa	353 16.7	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 56.9	N19 07.5
Atria	107 30.4	S69 03.1
Avior	234 19.2	S59 32.8
Bellatrix	278 33.6	N 6 21.6
Betelgeuse	271 03.0	N 7 24.5
Canopus	263 57.2	S52 42.0
Capella	280 36.7	N46 00.4
Deneb	49 31.9	N45 19.5
Denebola	182 35.2	N14 30.5
Diphda	348 57.0	S17 55.1
Dubhe	193 53.7	N61 41.4
Elnath	278 14.5	N28 36.9
Eltanin	90 46.3	N51 29.5
Enif	33 48.1	N 9 55.9
Fomalhaut	15 25.1	S29 33.3
Gacrux	172 02.7	S57 11.0
Gienah	175 53.9	S17 36.5
Hadar	148 49.9	S60 26.0
Hamal	328 02.2	N23 31.0
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 19.8	N74 06.7
Markab	13 39.4	N15 16.2
Menkar	314 16.5	N 4 08.2
Menkent	148 09.2	S36 25.8
Miaplacidus	221 41.0	S69 46.0
Mirfak	308 42.4	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.6	S56 41.7
Pollux	243 29.7	N27 59.8
Procyon	245 01.4	N 5 11.7
Rasalhague	96 07.4	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.5	S 8 11.2
Rigil Kent.	139 53.6	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 41.8	N56 36.0
Shaula	96 23.4	S37 06.7
Sirius	258 35.2	S16 43.9
Spica	158 32.7	S11 13.4
Suhail	222 53.9	S43 28.9
Vega	80 39.5	N38 47.9
Zuben'ubi	137 06.8	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	230 43.5	11 53
Mars	270 17.1	9 14
Jupiter	322 49.8	5 43
Saturn	167 34.6	16 02

UT	SUN				MOON						
	GHA		Dec		GHA		v		Dec		d	HP
d h	°	′	°	′	°	′	′		°	′	′	′
2 00	178	25.1	N17	54.1	151	15.7	10.0	N	3	27.7	14.2	59.9
01	193	25.1		53.5	165	44.7	10.0		3	13.5	14.3	59.9
02	208	25.1		52.8	180	13.7	10.0		2	59.2	14.2	59.9
03	223	25.2	. .	52.2	194	42.7	10.0		2	45.0	14.3	59.9
04	238	25.2		51.6	209	11.7	10.1		2	30.7	14.3	59.9
05	253	25.3		50.9	223	40.8	10.0		2	16.4	14.3	59.9
06	268	25.3	N17	50.3	238	09.8	10.0	N	2	02.1	14.4	59.9
07	283	25.3		49.6	252	38.8	10.1		1	47.7	14.3	59.9
08	298	25.4		49.0	267	07.9	10.0		1	33.4	14.4	59.9
09	313	25.4	. .	48.4	281	36.9	10.1		1	19.0	14.3	59.9
10	328	25.5		47.7	296	06.0	10.0		1	04.7	14.4	59.9
11	343	25.5		47.1	310	35.0	10.1		0	50.3	14.4	59.9
12	358	25.6	N17	46.4	325	04.1	10.0	N	0	35.9	14.3	59.9
13	13	25.6		45.8	339	33.1	10.1		0	21.6	14.4	59.9
14	28	25.6		45.2	354	02.2	10.1	N	0	07.2	14.4	59.9
15	43	25.7	. .	44.5	8	31.3	10.0	S	0	07.2	14.4	59.9
16	58	25.7		43.9	23	00.3	10.1		0	21.6	14.3	59.9
17	73	25.8		43.2	37	29.4	10.0		0	35.9	14.4	59.9
18	88	25.8	N17	42.6	51	58.4	10.1	S	0	50.3	14.4	59.9
19	103	25.9		41.9	66	27.5	10.0		1	04.7	14.3	59.9
20	118	25.9		41.3	80	56.5	10.1		1	19.0	14.4	60.0
21	133	26.0	. .	40.7	95	25.6	10.0		1	33.4	14.3	60.0
22	148	26.0		40.0	109	54.6	10.1		1	47.7	14.3	60.0
23	163	26.1		39.4	124	23.7	10.0		2	02.0	14.4	59.9
3 00	178	26.1	N17	38.7	138	52.7	10.0	S	2	16.4	14.3	59.9
01	193	26.1		38.1	153	21.7	10.0		2	30.7	14.2	59.9
02	208	26.2		37.4	167	50.7	10.0		2	44.9	14.3	59.9
03	223	26.2	. .	36.8	182	19.7	10.0		2	59.2	14.2	59.9
04	238	26.3		36.1	196	48.7	10.0		3	13.4	14.3	59.9
05	253	26.3		35.5	211	17.7	9.9		3	27.7	14.2	59.9
06	268	26.4	N17	34.8	225	46.6	10.0	S	3	41.9	14.2	59.9
07	283	26.4		34.2	240	15.6	9.9		3	56.1	14.1	59.9
08	298	26.5		33.5	254	44.5	10.0		4	10.2	14.1	59.9
09	313	26.5	. .	32.9	269	13.5	9.9		4	24.3	14.1	59.9
10	328	26.6		32.2	283	42.4	9.9		4	38.4	14.1	59.9
11	343	26.6		31.6	298	11.3	9.9		4	52.5	14.1	59.9
12	358	26.7	N17	30.9	312	40.2	9.8	S	5	06.6	14.0	59.9
13	13	26.7		30.3	327	09.0	9.9		5	20.6	13.9	59.9
14	28	26.8		29.6	341	37.9	9.8		5	34.5	14.0	59.9
15	43	26.8	. .	29.0	356	06.7	9.8		5	48.5	13.9	59.9
16	58	26.9		28.3	10	35.5	9.8		6	02.4	13.8	59.9
17	73	26.9		27.7	25	04.3	9.8		6	16.2	13.9	59.9
18	88	27.0	N17	27.0	39	33.1	9.7	S	6	30.1	13.8	59.9
19	103	27.0		26.3	54	01.8	9.7		6	43.9	13.7	59.9
20	118	27.1		25.7	68	30.5	9.7		6	57.6	13.7	59.9
21	133	27.1	. .	25.0	82	59.2	9.7		7	11.3	13.6	59.9
22	148	27.2		24.4	97	27.9	9.6		7	24.9	13.6	59.9
23	163	27.2		23.7	111	56.5	9.7		7	38.5	13.6	59.8
4 00	178	27.3	N17	23.1	126	25.2	9.6	S	7	52.1	13.5	59.8
01	193	27.3		22.4	140	53.8	9.5		8	05.6	13.5	59.8
02	208	27.4		21.7	155	22.3	9.6		8	19.1	13.4	59.8
03	223	27.5	. .	21.1	169	50.9	9.5		8	32.5	13.3	59.8
04	238	27.5		20.4	184	19.4	9.5		8	45.8	13.3	59.8
05	253	27.6		19.8	198	47.9	9.4		8	59.1	13.2	59.8
06	268	27.6	N17	19.1	213	16.3	9.5	S	9	12.3	13.2	59.8
07	283	27.7		18.4	227	44.8	9.4		9	25.5	13.1	59.8
08	298	27.7		17.8	242	13.2	9.3		9	38.6	13.1	59.8
09	313	27.8	. .	17.1	256	41.5	9.4		9	51.7	13.0	59.8
10	328	27.8		16.5	271	09.9	9.3		10	04.7	12.9	59.8
11	343	27.9		15.8	285	38.2	9.2		10	17.6	12.9	59.7
12	358	27.9	N17	15.1	300	06.4	9.3	S	10	30.5	12.8	59.7
13	13	28.0		14.5	314	34.7	9.2		10	43.3	12.7	59.7
14	28	28.1		13.8	329	02.9	9.2		10	56.0	12.7	59.7
15	43	28.1	. .	13.1	343	31.1	9.1		11	08.7	12.6	59.7
16	58	28.2		12.5	357	59.2	9.1		11	21.3	12.5	59.7
17	73	28.2		11.8	12	27.3	9.0		11	33.8	12.4	59.7
18	88	28.3	N17	11.1	26	55.3	9.1	S	11	46.2	12.4	59.7
19	103	28.3		10.5	41	23.4	9.0		11	58.6	12.3	59.7
20	118	28.4		09.8	55	51.4	8.9		12	10.9	12.2	59.6
21	133	28.5	. .	09.1	70	19.3	8.9		12	23.1	12.2	59.6
22	148	28.5		08.5	84	47.2	8.9		12	35.3	12.0	59.6
23	163	28.6		07.8	99	15.1	8.8	S	12	47.3	12.0	59.6
	SD	15.8	d	0.7	SD		16.3			16.3		16.3

TUESDAY

WEDNESDAY

THURSDAY

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 2	Moonrise 3	Moonrise 4	Moonrise 5
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	▭	▭	07 54	10 06	12 23	15 05
N 70	////	////	01 40	07 56	09 59	12 05	14 21
68	////	////	02 23	07 58	09 53	11 50	13 52
66	////	00 48	02 52	07 59	09 48	11 38	13 31
64	////	01 49	03 13	08 00	09 44	11 28	13 14
62	////	02 21	03 30	08 01	09 40	11 20	13 00
60	00 43	02 45	03 44	08 02	09 37	11 13	12 48
N 58	01 38	03 04	03 56	08 03	09 35	11 07	12 38
56	02 09	03 19	04 07	08 04	09 32	11 01	12 30
54	02 31	03 32	04 16	08 04	09 30	10 56	12 22
52	02 48	03 43	04 24	08 05	09 28	10 52	12 15
50	03 03	03 53	04 32	08 05	09 27	10 48	12 09
45	03 31	04 14	04 47	08 06	09 23	10 39	11 55
N 40	03 53	04 30	05 00	08 07	09 20	10 32	11 44
35	04 09	04 43	05 11	08 08	09 17	10 26	11 35
30	04 23	04 54	05 20	08 09	09 15	10 21	11 27
20	04 45	05 13	05 36	08 10	09 11	10 11	11 13
N 10	05 02	05 28	05 50	08 11	09 07	10 03	11 00
0	05 16	05 41	06 03	08 13	09 04	09 56	10 49
S 10	05 28	05 54	06 15	08 14	09 01	09 48	10 38
20	05 39	06 06	06 29	08 15	08 57	09 41	10 26
30	05 50	06 19	06 44	08 16	08 53	09 32	10 12
35	05 56	06 26	06 53	08 17	08 51	09 27	10 05
40	06 02	06 34	07 03	08 18	08 49	09 21	09 56
45	06 08	06 43	07 15	08 19	08 46	09 14	09 46
S 50	06 15	06 54	07 29	08 20	08 43	09 07	09 33
52	06 18	06 59	07 36	08 21	08 41	09 03	09 28
54	06 21	07 04	07 43	08 21	08 40	08 59	09 21
56	06 25	07 10	07 51	08 22	08 38	08 55	09 14
58	06 28	07 16	08 00	08 23	08 36	08 50	09 06
S 60	06 32	07 23	08 11	08 24	08 34	08 44	08 58

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 2	Moonset 3	Moonset 4	Moonset 5
°	h m	h m	h m	h m	h m	h m	h m
N 72	▭	////	////	20 18	19 56	19 28	18 40
N 70	22 26	////	////	20 20	20 06	19 49	19 25
68	21 45	////	////	20 21	20 14	20 05	19 55
66	21 18	23 13	////	20 23	20 21	20 19	20 17
64	20 57	22 19	////	20 24	20 27	20 30	20 35
62	20 40	21 48	////	20 25	20 32	20 40	20 50
60	20 26	21 25	23 18	20 26	20 36	20 48	21 03
N 58	20 15	21 07	22 30	20 27	20 40	20 55	21 14
56	20 04	20 52	22 01	20 28	20 44	21 02	21 23
54	19 55	20 39	21 40	20 28	20 47	21 07	21 32
52	19 47	20 28	21 22	20 29	20 50	21 13	21 39
50	19 40	20 18	21 08	20 29	20 52	21 17	21 46
45	19 25	19 58	20 40	20 31	20 58	21 28	22 01
N 40	19 12	19 42	20 19	20 32	21 03	21 36	22 13
35	19 01	19 29	20 02	20 33	21 07	21 44	22 23
30	18 52	19 18	19 49	20 33	21 11	21 50	22 33
20	18 36	19 00	19 27	20 35	21 17	22 02	22 48
N 10	18 22	18 45	19 10	20 36	21 23	22 12	23 02
0	18 10	18 31	18 57	20 37	21 28	22 21	23 15
S 10	17 57	18 19	18 44	20 38	21 34	22 30	23 28
20	17 44	18 07	18 33	20 39	21 39	22 40	23 42
30	17 28	17 54	18 22	20 40	21 46	22 52	23 58
35	17 20	17 46	18 17	20 41	21 50	22 59	24 07
40	17 10	17 38	18 11	20 42	21 54	23 06	24 18
45	16 58	17 29	18 05	20 43	21 59	23 15	24 31
S 50	16 44	17 19	17 58	20 44	22 05	23 26	24 46
52	16 37	17 14	17 55	20 44	22 08	23 31	24 53
54	16 30	17 09	17 52	20 45	22 11	23 37	25 01
56	16 22	17 03	17 49	20 46	22 14	23 43	25 10
58	16 13	16 57	17 45	20 46	22 18	23 50	25 21
S 60	16 02	16 50	17 41	20 47	22 22	23 58	25 32

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
2	06 20	06 18	12 06	14 25	01 59	03	10
3	06 16	06 13	12 06	15 16	02 50	04	18
4	06 11	06 08	12 06	16 08	03 42	05	28

UT	ARIES	VENUS −4.0		MARS +1.4		JUPITER −2.5		SATURN +0.9		STARS		
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Name	SHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
5 00	313 12.2	181 23.4	N18 59.4	222 01.6	N23 46.6	275 52.1	N13 22.4	120 38.3	S 2 49.5	Acamar	315 19.3	S40 15.2
01	328 14.7	196 22.7	58.7	237 02.2	46.6	290 54.4	22.4	135 40.6	49.6	Achernar	335 27.5	S57 10.3
02	343 17.1	211 22.0	57.9	252 02.8	46.6	305 56.6	22.5	150 42.9	49.7	Acrux	173 11.2	S63 10.1
03	358 19.6	226 21.3	57.1	267 03.5	46.6	320 58.9	22.5	165 45.2	49.7	Adhara	255 13.9	S28 59.2
04	13 22.1	241 20.6	56.4	282 04.1	46.7	336 01.2	22.6	180 47.5	49.8	Aldebaran	290 51.0	N16 31.9
05	28 24.5	256 19.9	55.6	297 04.7	46.7	351 03.4	22.6	195 49.7	49.9			
06	43 27.0	271 19.2	N18 54.9	312 05.4	N23 46.7	6 05.7	N13 22.7	210 52.0	S 2 50.0	Alioth	166 22.0	N55 54.0
07	58 29.4	286 18.5	54.1	327 06.0	46.7	21 08.0	22.8	225 54.3	50.1	Alkaid	153 00.0	N49 15.5
08	73 31.9	301 17.8	53.4	342 06.7	46.7	36 10.2	22.8	240 56.6	50.2	Al Na'ir	27 44.9	S46 54.0
F 09	88 34.4	316 17.1	52.6	357 07.3	46.7	51 12.5	22.9	255 58.9	50.2	Alnilam	275 47.9	S 1 11.6
R 10	103 36.8	331 16.4	51.8	12 07.9	46.8	66 14.8	22.9	271 01.2	50.3	Alphard	217 57.7	S 8 42.6
I 11	118 39.3	346 15.7	51.1	27 08.6	46.8	81 17.0	23.0	286 03.4	50.4			
D 12	133 41.8	1 15.0	N18 50.3	42 09.2	N23 46.8	96 19.3	N13 23.0	301 05.7	S 2 50.5	Alphecca	126 12.0	N26 40.7
A 13	148 44.2	16 14.3	49.5	57 09.9	46.8	111 21.6	23.1	316 08.0	50.6	Alpheratz	357 44.6	N29 09.3
Y 14	163 46.7	31 13.6	48.8	72 10.5	46.8	126 23.8	23.1	331 10.3	50.7	Altair	62 09.2	N 8 54.2
15	178 49.2	46 12.9	48.0	87 11.1	46.8	141 26.1	23.2	346 12.6	50.8	Ankaa	353 16.7	S42 14.2
16	193 51.6	61 12.2	47.2	102 11.8	46.8	156 28.4	23.2	1 14.9	50.8	Antares	112 27.7	S26 27.5
17	208 54.1	76 11.6	46.5	117 12.4	46.8	171 30.7	23.3	16 17.1	50.9			
18	223 56.6	91 10.9	N18 45.7	132 13.1	N23 46.9	186 32.9	N13 23.4	31 19.4	S 2 51.0	Arcturus	145 56.9	N19 07.5
19	238 59.0	106 10.2	44.9	147 13.7	46.9	201 35.2	23.4	46 21.7	51.1	Atria	107 30.4	S69 03.1
20	254 01.5	121 09.5	44.2	162 14.3	46.9	216 37.5	23.5	61 24.0	51.2	Avior	234 19.2	S59 32.8
21	269 03.9	136 08.8	43.4	177 15.0	46.9	231 39.7	23.5	76 26.3	51.3	Bellatrix	278 33.6	N 6 21.6
22	284 06.4	151 08.1	42.6	192 15.6	46.9	246 42.0	23.6	91 28.6	51.4	Betelgeuse	271 02.9	N 7 24.5
23	299 08.9	166 07.4	41.8	207 16.3	46.9	261 44.3	23.6	106 30.8	51.4			
6 00	314 11.3	181 06.7	N18 41.1	222 16.9	N23 46.9	276 46.6	N13 23.7	121 33.1	S 2 51.5	Canopus	263 57.2	S52 42.0
01	329 13.8	196 06.1	40.3	237 17.5	46.9	291 48.8	23.7	136 35.4	51.6	Capella	280 36.7	N46 00.4
02	344 16.3	211 05.4	39.5	252 18.2	46.9	306 51.1	23.8	151 37.7	51.7	Deneb	49 31.9	N45 19.5
03	359 18.7	226 04.7	38.7	267 18.8	47.0	321 53.4	23.8	166 40.0	51.8	Denebola	182 35.2	N14 30.5
04	14 21.2	241 04.0	37.9	282 19.5	47.0	336 55.6	23.9	181 42.2	51.9	Diphda	348 57.0	S17 55.1
05	29 23.7	256 03.3	37.2	297 20.1	47.0	351 57.9	23.9	196 44.5	52.0			
06	44 26.1	271 02.6	N18 36.4	312 20.8	N23 47.0	7 00.2	N13 24.0	211 46.8	S 2 52.0	Dubhe	193 53.8	N61 41.4
07	59 28.6	286 01.9	35.6	327 21.4	47.0	22 02.5	24.0	226 49.1	52.1	Elnath	278 14.5	N28 36.9
S 08	74 31.1	301 01.3	34.8	342 22.0	47.0	37 04.7	24.1	241 51.4	52.2	Eltanin	90 46.4	N51 29.5
A 09	89 33.5	316 00.6	34.0	357 22.7	47.0	52 07.0	24.1	256 53.6	52.3	Enif	33 48.1	N 9 55.9
T 10	104 36.0	330 59.9	33.3	12 23.3	47.0	67 09.3	24.2	271 55.9	52.4	Fomalhaut	15 25.1	S29 33.3
U 11	119 38.4	345 59.2	32.5	27 24.0	47.0	82 11.6	24.2	286 58.2	52.5			
R 12	134 40.9	0 58.5	N18 31.7	42 24.6	N23 47.0	97 13.8	N13 24.3	302 00.5	S 2 52.6	Gacrux	172 02.8	S57 11.0
D 13	149 43.4	15 57.8	30.9	57 25.3	47.0	112 16.1	24.3	317 02.8	52.6	Gienah	175 53.9	S17 36.5
A 14	164 45.8	30 57.2	30.1	72 25.9	47.0	127 18.4	24.4	332 05.0	52.7	Hadar	148 49.9	S60 26.0
Y 15	179 48.3	45 56.5	29.3	87 26.5	47.0	142 20.7	24.4	347 07.3	52.8	Hamal	328 02.2	N23 31.1
16	194 50.8	60 55.8	28.5	102 27.2	47.0	157 23.0	24.5	2 09.6	52.9	Kaus Aust.	83 45.2	S34 22.7
17	209 53.2	75 55.1	27.7	117 27.8	47.0	172 25.2	24.6	17 11.9	53.0			
18	224 55.7	90 54.5	N18 26.9	132 28.5	N23 47.1	187 27.5	N13 24.6	32 14.2	S 2 53.1	Kochab	137 19.8	N74 06.8
19	239 58.2	105 53.8	26.1	147 29.1	47.1	202 29.8	24.7	47 16.4	53.2	Markab	13 39.4	N15 16.2
20	255 00.6	120 53.1	25.4	162 29.8	47.1	217 32.1	24.7	62 18.7	53.2	Menkar	314 16.4	N 4 08.2
21	270 03.1	135 52.4	24.6	177 30.4	47.1	232 34.3	24.8	77 21.0	53.3	Menkent	148 09.2	S36 25.8
22	285 05.6	150 51.7	23.8	192 31.0	47.1	247 36.6	24.8	92 23.3	53.4	Miaplacidus	221 41.0	S69 46.0
23	300 08.0	165 51.1	23.0	207 31.7	47.1	262 38.9	24.9	107 25.6	53.5			
7 00	315 10.5	180 50.4	N18 22.2	222 32.3	N23 47.1	277 41.2	N13 24.9	122 27.8	S 2 53.6	Mirfak	308 42.3	N49 54.0
01	330 12.9	195 49.7	21.4	237 33.0	47.1	292 43.5	25.0	137 30.1	53.7	Nunki	75 59.6	S26 16.8
02	345 15.4	210 49.0	20.6	252 33.6	47.1	307 45.7	25.0	152 32.4	53.8	Peacock	53 20.6	S56 41.7
03	0 17.9	225 48.4	19.8	267 34.3	47.1	322 48.0	25.1	167 34.7	53.8	Pollux	243 29.7	N27 59.8
04	15 20.3	240 47.7	19.0	282 34.9	47.1	337 50.3	25.1	182 37.0	53.9	Procyon	245 01.4	N 5 11.7
05	30 22.8	255 47.0	18.2	297 35.6	47.1	352 52.6	25.2	197 39.2	54.0			
06	45 25.3	270 46.3	N18 17.4	312 36.2	N23 47.1	7 54.9	N13 25.2	212 41.5	S 2 54.1	Rasalhague	96 07.4	N12 33.3
07	60 27.7	285 45.7	16.6	327 36.8	47.1	22 57.2	25.3	227 43.8	54.2	Regulus	207 45.2	N11 54.6
08	75 30.2	300 45.0	15.8	342 37.5	47.1	37 59.4	25.3	242 46.1	54.3	Rigel	281 13.5	S 8 11.2
S 09	90 32.7	315 44.3	15.0	357 38.1	47.1	53 01.7	25.4	257 48.3	54.4	Rigil Kent.	139 53.6	S60 53.2
U 10	105 35.1	330 43.7	14.2	12 38.8	47.1	68 04.0	25.4	272 50.6	54.5	Sabik	102 13.8	S15 44.3
N 11	120 37.6	345 43.0	13.3	27 39.4	47.1	83 06.3	25.5	287 52.9	54.5			
D 12	135 40.0	0 42.3	N18 12.5	42 40.1	N23 47.1	98 08.6	N13 25.5	302 55.2	S 2 54.6	Schedar	349 41.8	N56 36.0
A 13	150 42.5	15 41.6	11.7	57 40.7	47.1	113 10.8	25.6	317 57.5	54.7	Shaula	96 23.4	S37 06.7
Y 14	165 45.0	30 41.0	10.9	72 41.4	47.1	128 13.1	25.6	332 59.7	54.8	Sirius	258 35.2	S16 43.9
15	180 47.4	45 40.3	10.1	87 42.0	47.1	143 15.4	25.7	348 02.0	54.9	Spica	158 32.7	S11 13.4
16	195 49.9	60 39.6	09.3	102 42.7	47.0	158 17.7	25.7	3 04.3	55.0	Suhail	222 53.9	S43 28.8
17	210 52.4	75 39.0	08.5	117 43.3	47.0	173 20.0	25.8	18 06.6	55.1			
18	225 54.8	90 38.3	N18 07.7	132 43.9	N23 47.0	188 22.3	N13 25.8	33 08.8	S 2 55.1	Vega	80 39.5	N38 47.9
19	240 57.3	105 37.6	06.9	147 44.6	47.0	203 24.6	25.8	48 11.1	55.2	Zuben'ubi	137 06.9	S16 05.4
20	255 59.8	120 37.0	06.0	162 45.2	47.0	218 26.8	25.9	63 13.4	55.3		SHA	Mer. Pass.
21	271 02.2	135 36.3	05.2	177 45.9	47.0	233 29.1	25.9	78 15.7	55.4		° ′	h m
22	286 04.7	150 35.6	04.4	192 46.5	47.0	248 31.4	26.0	93 17.9	55.5	Venus	226 55.4	11 56
23	301 07.2	165 35.0	03.6	207 47.2	47.0	263 33.7	26.0	108 20.2	55.6	Mars	268 05.6	9 10
	h m									Jupiter	322 35.2	5 32
Mer. Pass.	3 02.7	v −0.7	d 0.8	v 0.6	d 0.0	v 2.3	d 0.1	v 2.3	d 0.1	Saturn	167 21.8	15 51

2011 AUGUST 5, 6, 7 (FRI., SAT., SUN.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
5 00	178 28.6	N17 07.1	113 42.9	8.8	S12 59.3	11.9	59.6
01	193 28.7	06.4	128 10.7	8.8	13 11.2	11.8	59.6
02	208 28.8	05.8	142 38.5	8.7	13 23.0	11.8	59.6
03	223 28.8	05.1	157 06.2	8.7	13 34.8	11.6	59.5
04	238 28.9	04.4	171 33.9	8.6	13 46.4	11.6	59.5
05	253 28.9	03.8	186 01.5	8.6	13 58.0	11.4	59.5
06	268 29.0	N17 03.1	200 29.1	8.6	S14 09.4	11.4	59.5
07	283 29.1	02.4	214 56.7	8.5	14 20.8	11.3	59.5
08	298 29.1	01.7	229 24.2	8.5	14 32.1	11.2	59.5
F 09	313 29.2	01.1	243 51.7	8.4	14 43.3	11.1	59.5
R 10	328 29.3	17 00.4	258 19.1	8.4	14 54.4	11.0	59.4
I 11	343 29.3	16 59.7	272 46.5	8.4	15 05.4	10.9	59.4
D 12	358 29.4	N16 59.0	287 13.9	8.3	S15 16.3	10.8	59.4
A 13	13 29.4	58.4	301 41.2	8.3	15 27.1	10.7	59.4
Y 14	28 29.5	57.7	316 08.5	8.2	15 37.8	10.6	59.4
15	43 29.6	57.0	330 35.7	8.2	15 48.4	10.6	59.4
16	58 29.6	56.3	345 02.9	8.1	15 59.0	10.4	59.4
17	73 29.7	55.7	359 30.0	8.1	16 09.4	10.3	59.3
18	88 29.8	N16 55.0	13 57.1	8.1	S16 19.7	10.2	59.3
19	103 29.8	54.3	28 24.2	8.0	16 29.9	10.1	59.3
20	118 29.9	53.6	42 51.2	8.0	16 40.0	10.0	59.3
21	133 30.0	52.9	57 18.2	7.9	16 50.0	9.9	59.3
22	148 30.0	52.3	71 45.1	7.9	16 59.9	9.7	59.3
23	163 30.1	51.6	86 12.0	7.9	17 09.6	9.7	59.2
6 00	178 30.1	N16 50.9	100 38.9	7.8	S17 19.3	9.6	59.2
01	193 30.2	50.2	115 05.7	7.7	17 28.9	9.4	59.2
02	208 30.3	49.5	129 32.4	7.8	17 38.3	9.3	59.2
03	223 30.3	48.9	143 59.2	7.6	17 47.6	9.3	59.2
04	238 30.4	48.2	158 25.8	7.7	17 56.9	9.1	59.2
05	253 30.5	47.5	172 52.5	7.6	18 06.0	9.0	59.1
06	268 30.5	N16 46.8	187 19.1	7.6	S18 15.0	8.8	59.1
07	283 30.6	46.1	201 45.7	7.5	18 23.8	8.8	59.1
S 08	298 30.7	45.4	216 12.2	7.5	18 32.6	8.6	59.1
A 09	313 30.8	44.8	230 38.7	7.4	18 41.2	8.5	59.1
T 10	328 30.8	44.1	245 05.1	7.4	18 49.7	8.4	59.1
U 11	343 30.9	43.4	259 31.5	7.4	18 58.1	8.3	59.0
R 12	358 31.0	N16 42.7	273 57.9	7.3	S19 06.4	8.2	59.0
D 13	13 31.0	42.0	288 24.2	7.3	19 14.6	8.0	59.0
A 14	28 31.1	41.3	302 50.5	7.3	19 22.6	7.9	59.0
Y 15	43 31.2	40.6	317 16.8	7.2	19 30.5	7.8	59.0
16	58 31.2	39.9	331 43.0	7.2	19 38.3	7.6	58.9
17	73 31.3	39.3	346 09.2	7.1	19 45.9	7.6	58.9
18	88 31.4	N16 38.6	0 35.3	7.1	S19 53.5	7.4	58.9
19	103 31.4	37.9	15 01.4	7.1	20 00.9	7.2	58.9
20	118 31.5	37.2	29 27.5	7.1	20 08.1	7.2	58.9
21	133 31.6	36.5	43 53.6	7.0	20 15.3	7.0	58.9
22	148 31.7	35.8	58 19.6	7.0	20 22.3	6.9	58.8
23	163 31.7	35.1	72 45.6	6.9	20 29.2	6.7	58.8
7 00	178 31.8	N16 34.4	87 11.5	7.0	S20 35.9	6.6	58.8
01	193 31.9	33.7	101 37.5	6.8	20 42.5	6.5	58.8
02	208 32.0	33.0	116 03.3	6.9	20 49.0	6.4	58.8
03	223 32.0	32.3	130 29.2	6.8	20 55.4	6.2	58.7
04	238 32.1	31.6	144 55.0	6.9	21 01.6	6.1	58.7
05	253 32.2	30.9	159 20.9	6.7	21 07.7	5.9	58.7
06	268 32.2	N16 30.2	173 46.6	6.8	S21 13.6	5.9	58.7
07	283 32.3	29.6	188 12.4	6.7	21 19.5	5.6	58.7
08	298 32.4	28.9	202 38.1	6.7	21 25.1	5.6	58.6
S 09	313 32.5	28.2	217 03.8	6.7	21 30.7	5.4	58.6
U 10	328 32.5	27.5	231 29.5	6.7	21 36.1	5.2	58.6
N 11	343 32.6	26.8	245 55.2	6.6	21 41.3	5.2	58.6
D 12	358 32.7	N16 26.1	260 20.8	6.7	S21 46.5	5.0	58.6
A 13	13 32.8	25.4	274 46.5	6.6	21 51.5	4.8	58.5
Y 14	28 32.8	24.7	289 12.1	6.6	21 56.3	4.7	58.5
15	43 32.9	24.0	303 37.7	6.5	22 01.0	4.6	58.5
16	58 33.0	23.3	318 03.2	6.6	22 05.6	4.4	58.5
17	73 33.1	22.6	332 28.8	6.5	22 10.0	4.3	58.5
18	88 33.2	N16 21.9	346 54.3	6.5	S22 14.3	4.1	58.4
19	103 33.2	21.2	1 19.8	6.6	22 18.4	4.0	58.4
20	118 33.3	20.5	15 45.4	6.5	22 22.4	3.9	58.4
21	133 33.4	19.8	30 10.9	6.5	22 26.3	3.7	58.4
22	148 33.5	19.1	44 36.4	6.5	22 30.0	3.6	58.4
23	163 33.5	18.4	59 01.9	6.4	S22 33.6	3.4	58.3
	SD 15.8	d 0.7	SD 16.2		16.1		16.0

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 5	Moonrise 6	Moonrise 7	Moonrise 8
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	00 51	15 05	▬	▬	▬
N 70	////	////	02 02	14 21	▬	▬	▬
68	////	////	02 38	13 52	16 05	▬	▬
66	////	01 20	03 03	13 31	15 26	17 20	18 54
64	////	02 05	03 23	13 14	14 59	16 38	17 57
62	////	02 33	03 38	13 00	14 38	16 09	17 24
60	01 12	02 54	03 52	12 48	14 22	15 48	16 59
N 58	01 53	03 12	04 03	12 38	14 07	15 30	16 39
56	02 19	03 26	04 13	12 30	13 55	15 15	16 23
54	02 39	03 38	04 21	12 22	13 45	15 02	16 09
52	02 55	03 49	04 29	12 15	13 36	14 51	15 57
50	03 09	03 58	04 36	12 09	13 27	14 41	15 46
45	03 36	04 17	04 51	11 55	13 10	14 20	15 24
N 40	03 56	04 33	05 03	11 44	12 55	14 03	15 06
35	04 12	04 45	05 13	11 35	12 43	13 49	14 51
30	04 25	04 56	05 22	11 27	12 32	13 37	14 38
20	04 46	05 14	05 37	11 13	12 14	13 16	14 15
N 10	05 02	05 28	05 50	11 00	11 59	12 58	13 56
0	05 16	05 41	06 02	10 49	11 44	12 41	13 38
S 10	05 27	05 53	06 15	10 38	11 30	12 24	13 20
20	05 38	06 04	06 27	10 26	11 14	12 06	13 01
30	05 48	06 17	06 42	10 12	10 57	11 46	12 39
35	05 54	06 24	06 50	10 05	10 47	11 34	12 26
40	05 59	06 31	07 00	09 56	10 35	11 20	12 11
45	06 05	06 40	07 11	09 46	10 21	11 04	11 53
S 50	06 11	06 50	07 24	09 33	10 05	10 44	11 32
52	06 14	06 54	07 31	09 28	09 57	10 34	11 21
54	06 16	06 59	07 37	09 21	09 49	10 24	11 09
56	06 19	07 04	07 45	09 14	09 39	10 12	10 56
58	06 23	07 10	07 54	09 06	09 28	09 58	10 40
S 60	06 26	07 17	08 04	08 58	09 16	09 42	10 22

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 5	Moonset 6	Moonset 7	Moonset 8
°	h m	h m	h m	h m	h m	h m	h m
N 72	23 06	////	////	18 40	▬	▬	▬
N 70	22 05	////	////	19 25	▬	▬	▬
68	21 30	////	////	19 55	19 38	▬	▬
66	21 06	22 44	////	20 17	20 18	20 23	20 49
64	20 47	22 03	////	20 35	20 45	21 05	21 46
62	20 32	21 36	////	20 50	21 07	21 34	22 19
60	20 19	21 15	22 53	21 03	21 24	21 56	22 44
N 58	20 08	20 58	22 16	21 14	21 39	22 14	23 04
56	19 58	20 44	21 50	21 23	21 52	22 30	23 20
54	19 49	20 32	21 31	21 32	22 03	22 43	23 34
52	19 42	20 22	21 15	21 39	22 12	22 54	23 46
50	19 35	20 13	21 01	21 46	22 21	23 04	23 57
45	19 21	19 54	20 35	22 01	22 40	23 26	24 19
N 40	19 09	19 38	20 15	22 13	22 55	23 43	24 37
35	18 59	19 26	19 59	22 23	23 08	23 57	24 53
30	18 50	19 15	19 46	22 33	23 19	24 10	00 10
20	18 35	18 58	19 25	22 48	23 38	24 32	00 32
N 10	18 22	18 44	19 09	23 02	23 55	24 51	00 51
0	18 09	18 31	18 56	23 15	24 11	00 11	01 08
S 10	17 57	18 19	18 45	23 28	24 27	00 27	01 26
20	17 45	18 08	18 34	23 42	24 44	00 44	01 45
30	17 30	17 55	18 24	23 58	25 03	01 03	02 06
35	17 22	17 48	18 19	24 07	00 07	01 15	02 19
40	17 12	17 41	18 13	24 18	00 18	01 28	02 34
45	17 01	17 33	18 08	24 31	00 31	01 43	02 51
S 50	16 48	17 23	18 02	24 46	00 46	02 03	03 13
52	16 42	17 18	17 59	24 53	00 53	02 12	03 23
54	16 35	17 14	17 56	25 01	01 01	02 22	03 35
56	16 27	17 08	17 53	25 10	01 10	02 33	03 48
58	16 19	17 03	17 50	25 21	01 21	02 47	04 03
S 60	16 09	16 56	17 47	25 32	01 32	03 02	04 22

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
5	06 06	06 03	12 06	17 02	04 35	06	39
6	06 00	05 56	12 06	17 58	05 30	07	51
7	05 53	05 49	12 06	18 54	06 26	08	62

UT	ARIES	VENUS −4.0		MARS +1.4		JUPITER −2.5		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
8 00	316 09.6	180 34.3	N18 02.8	222 47.8	N23 47.0	278 36.0	N13 26.1	123 22.5	S 2 55.7
01	331 12.1	195 33.6	02.0	237 48.5	47.0	293 38.3	26.1	138 24.8	55.8
02	346 14.5	210 33.0	01.1	252 49.1	47.0	308 40.6	26.2	153 27.1	55.8
03	1 17.0	225 32.3	18 00.3	267 49.8	47.0	323 42.8	26.2	168 29.3	55.9
04	16 19.5	240 31.7	17 59.5	282 50.4	47.0	338 45.1	26.3	183 31.6	56.0
05	31 21.9	255 31.0	58.7	297 51.1	47.0	353 47.4	26.3	198 33.9	56.1
06	46 24.4	270 30.3	N17 57.8	312 51.7	N23 47.0	8 49.7	N13 26.4	213 36.2	S 2 56.2
07	61 26.9	285 29.7	57.0	327 52.4	47.0	23 52.0	26.4	228 38.4	56.3
08	76 29.3	300 29.0	56.2	342 53.0	46.9	38 54.3	26.5	243 40.7	56.4
M 09	91 31.8	315 28.4	55.4	357 53.7	46.9	53 56.6	26.5	258 43.0	56.5
O 10	106 34.3	330 27.7	54.5	12 54.3	46.9	68 58.9	26.6	273 45.3	56.5
N 11	121 36.7	345 27.0	53.7	27 55.0	46.9	84 01.2	26.6	288 47.5	56.6
D 12	136 39.2	0 26.4	N17 52.9	42 55.6	N23 46.9	99 03.5	N13 26.7	303 49.8	S 2 56.7
A 13	151 41.7	15 25.7	52.0	57 56.3	46.9	114 05.7	26.7	318 52.1	56.8
Y 14	166 44.1	30 25.1	51.2	72 56.9	46.9	129 08.0	26.8	333 54.4	56.9
15	181 46.6	45 24.4	50.4	87 57.5	46.9	144 10.3	26.8	348 56.6	57.0
16	196 49.0	60 23.7	49.6	102 58.2	46.9	159 12.6	26.8	3 58.9	57.1
17	211 51.5	75 23.1	48.7	117 58.8	46.8	174 14.9	26.9	19 01.2	57.2
18	226 54.0	90 22.4	N17 47.9	132 59.5	N23 46.8	189 17.2	N13 26.9	34 03.4	S 2 57.3
19	241 56.4	105 21.8	47.0	148 00.1	46.8	204 19.5	27.0	49 05.7	57.3
20	256 58.9	120 21.1	46.2	163 00.8	46.8	219 21.8	27.0	64 08.0	57.4
21	272 01.4	135 20.5	45.4	178 01.4	46.8	234 24.1	27.1	79 10.3	57.5
22	287 03.8	150 19.8	44.5	193 02.1	46.8	249 26.4	27.1	94 12.5	57.6
23	302 06.3	165 19.2	43.7	208 02.7	46.8	264 28.7	27.2	109 14.8	57.7
9 00	317 08.8	180 18.5	N17 42.9	223 03.4	N23 46.7	279 31.0	N13 27.2	124 17.1	S 2 57.8
01	332 11.2	195 17.9	42.0	238 04.0	46.7	294 33.3	27.3	139 19.4	57.9
02	347 13.7	210 17.2	41.2	253 04.7	46.7	309 35.5	27.3	154 21.6	58.0
03	2 16.2	225 16.5	40.3	268 05.4	46.7	324 37.8	27.3	169 23.9	58.0
04	17 18.6	240 15.9	39.5	283 06.0	46.7	339 40.1	27.4	184 26.2	58.1
05	32 21.1	255 15.2	38.7	298 06.7	46.7	354 42.4	27.4	199 28.5	58.2
06	47 23.5	270 14.6	N17 37.8	313 07.3	N23 46.7	9 44.7	N13 27.5	214 30.7	S 2 58.3
07	62 26.0	285 13.9	37.0	328 08.0	46.6	24 47.0	27.5	229 33.0	58.4
T 08	77 28.5	300 13.3	36.1	343 08.6	46.6	39 49.3	27.6	244 35.3	58.5
U 09	92 30.9	315 12.6	35.3	358 09.3	46.6	54 51.6	27.6	259 37.5	58.6
E 10	107 33.4	330 12.0	34.4	13 09.9	46.6	69 53.9	27.7	274 39.8	58.7
S 11	122 35.9	345 11.4	33.6	28 10.6	46.6	84 56.2	27.7	289 42.1	58.8
D 12	137 38.3	0 10.7	N17 32.7	43 11.2	N23 46.5	99 58.5	N13 27.8	304 44.4	S 2 58.8
A 13	152 40.8	15 10.1	31.9	58 11.9	46.5	115 00.8	27.8	319 46.6	58.9
Y 14	167 43.3	30 09.4	31.0	73 12.5	46.5	130 03.1	27.8	334 48.9	59.0
15	182 45.7	45 08.8	30.2	88 13.2	46.5	145 05.4	27.9	349 51.2	59.1
16	197 48.2	60 08.1	29.3	103 13.8	46.5	160 07.7	27.9	4 53.5	59.2
17	212 50.7	75 07.5	28.5	118 14.5	46.4	175 10.0	28.0	19 55.7	59.3
18	227 53.1	90 06.8	N17 27.6	133 15.1	N23 46.4	190 12.3	N13 28.0	34 58.0	S 2 59.4
19	242 55.6	105 06.2	26.7	148 15.8	46.4	205 14.6	28.1	50 00.3	59.5
20	257 58.0	120 05.5	25.9	163 16.4	46.4	220 16.9	28.1	65 02.5	59.6
21	273 00.5	135 04.9	25.0	178 17.1	46.4	235 19.2	28.1	80 04.8	59.6
22	288 03.0	150 04.3	24.2	193 17.7	46.3	250 21.5	28.2	95 07.1	59.7
23	303 05.4	165 03.6	23.3	208 18.4	46.3	265 23.8	28.2	110 09.4	59.8
10 00	318 07.9	180 03.0	N17 22.5	223 19.1	N23 46.3	280 26.1	N13 28.3	125 11.6	S 2 59.9
01	333 10.4	195 02.3	21.6	238 19.7	46.3	295 28.4	28.3	140 13.9	3 00.0
02	348 12.8	210 01.7	20.7	253 20.4	46.2	310 30.7	28.4	155 16.2	00.1
03	3 15.3	225 01.0	19.9	268 21.0	46.2	325 33.0	28.4	170 18.4	00.2
04	18 17.8	240 00.4	19.0	283 21.7	46.2	340 35.3	28.4	185 20.7	00.3
05	33 20.2	254 59.8	18.1	298 22.3	46.2	355 37.6	28.5	200 23.0	00.4
06	48 22.7	269 59.1	N17 17.3	313 23.0	N23 46.2	10 39.9	N13 28.5	215 25.2	S 3 00.5
W 07	63 25.1	284 58.5	16.4	328 23.6	46.1	25 42.2	28.6	230 27.5	00.5
E 08	78 27.6	299 57.9	15.5	343 24.3	46.1	40 44.5	28.6	245 29.8	00.6
D 09	93 30.1	314 57.2	14.7	358 24.9	46.1	55 46.8	28.7	260 32.1	00.7
N 10	108 32.5	329 56.6	13.8	13 25.6	46.0	70 49.1	28.7	275 34.3	00.8
E 11	123 35.0	344 55.9	12.9	28 26.3	46.0	85 51.4	28.7	290 36.6	00.9
S 12	138 37.5	359 55.3	N17 12.1	43 26.9	N23 46.0	100 53.7	N13 28.8	305 38.9	S 3 01.0
D 13	153 39.9	14 54.7	11.2	58 27.6	46.0	115 56.0	28.8	320 41.1	01.1
A 14	168 42.4	29 54.0	10.3	73 28.2	45.9	130 58.4	28.9	335 43.4	01.2
Y 15	183 44.9	44 53.4	09.5	88 28.9	45.9	146 00.7	28.9	350 45.7	01.3
16	198 47.3	59 52.8	08.6	103 29.5	45.9	161 03.0	29.0	5 47.9	01.3
17	213 49.8	74 52.1	07.7	118 30.2	45.9	176 05.3	29.0	20 50.2	01.4
18	228 52.3	89 51.5	N17 06.8	133 30.8	N23 45.8	191 07.6	N13 29.0	35 52.5	S 3 01.5
19	243 54.7	104 50.9	06.0	148 31.5	45.8	206 09.9	29.1	50 54.7	01.6
20	258 57.2	119 50.2	05.1	163 32.2	45.8	221 12.2	29.1	65 57.0	01.7
21	273 59.6	134 49.6	04.2	178 32.8	45.7	236 14.5	29.2	80 59.3	01.8
22	289 02.1	149 49.0	03.3	193 33.5	45.7	251 16.8	29.2	96 01.6	01.9
23	304 04.6	164 48.3	02.4	208 34.1	45.7	266 19.1	29.2	111 03.8	02.0
	h m								
Mer. Pass.	2 50.9	v −0.6	d 0.9	v 0.7	d 0.0	v 2.3	d 0.0	v 2.3	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.3	S40 15.2
Achernar	335 27.5	S57 10.3
Acrux	173 11.3	S63 10.1
Adhara	255 13.9	S28 59.2
Aldebaran	290 51.0	N16 31.9
Alioth	166 22.0	N55 54.0
Alkaid	153 00.0	N49 15.5
Al Na'ir	27 44.8	S46 54.0
Alnilam	275 47.9	S 1 11.6
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.0	N26 40.8
Alpheratz	357 44.6	N29 09.4
Altair	62 09.2	N 8 54.2
Ankaa	353 16.7	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 57.0	N19 07.5
Atria	107 30.4	S69 03.1
Avior	234 19.2	S59 32.8
Bellatrix	278 33.6	N 6 21.6
Betelgeuse	271 02.9	N 7 24.5
Canopus	263 57.1	S52 42.0
Capella	280 36.6	N46 00.4
Deneb	49 31.9	N45 19.5
Denebola	182 35.2	N14 30.5
Diphda	348 57.0	S17 55.1
Dubhe	193 53.8	N61 41.4
Elnath	278 14.5	N28 36.9
Eltanin	90 46.4	N51 29.5
Enif	33 48.1	N 9 55.9
Fomalhaut	15 25.1	S29 33.3
Gacrux	172 02.8	S57 11.0
Gienah	175 53.9	S17 36.5
Hadar	148 49.9	S60 26.0
Hamal	328 02.2	N23 31.1
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 19.9	N74 06.7
Markab	13 39.3	N15 16.2
Menkar	314 16.4	N 4 08.2
Menkent	148 09.2	S36 25.8
Miaplacidus	221 41.0	S69 46.0
Mirfak	308 42.3	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.6	S56 41.7
Pollux	243 29.6	N27 59.8
Procyon	245 01.4	N 5 11.7
Rasalhague	96 07.4	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.5	S 8 11.2
Rigil Kent.	139 53.6	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 41.7	N56 36.0
Shaula	96 23.4	S37 06.7
Sirius	258 35.1	S16 43.9
Spica	158 32.8	S11 13.4
Suhail	222 53.9	S43 28.8
Vega	80 39.5	N38 47.9
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	223 09.7	11 59
Mars	265 54.6	9 07
Jupiter	322 22.2	5 21
Saturn	167 08.3	15 40

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
8 00	178 33.6	N16 17.7	73 27.3	6.5	S22 37.0	3.3	58.3
01	193 33.7	17.0	87 52.8	6.5	22 40.3	3.1	58.3
02	208 33.8	16.3	102 18.3	6.4	22 43.4	3.0	58.3
03	223 33.9	15.5	116 43.7	6.5	22 46.4	2.9	58.3
04	238 33.9	14.8	131 09.2	6.5	22 49.3	2.7	58.2
05	253 34.0	14.1	145 34.7	6.4	22 52.0	2.6	58.2
06	268 34.1	N16 13.4	160 00.1	6.5	S22 54.6	2.4	58.2
07	283 34.2	12.7	174 25.6	6.5	22 57.0	2.3	58.2
08	298 34.3	12.0	188 51.1	6.4	22 59.3	2.1	58.2
M 09	313 34.3	11.3	203 16.5	6.5	23 01.4	2.0	58.1
O 10	328 34.4	10.6	217 42.0	6.5	23 03.4	1.9	58.1
N 11	343 34.5	09.9	232 07.5	6.5	23 05.3	1.7	58.1
D 12	358 34.6	N16 09.2	246 33.0	6.5	S23 07.0	1.5	58.1
A 13	13 34.7	08.5	260 58.5	6.5	23 08.5	1.4	58.1
Y 14	28 34.7	07.8	275 24.0	6.5	23 09.9	1.3	58.0
15	43 34.8	07.1	289 49.5	6.5	23 11.2	1.1	58.0
16	58 34.9	06.3	304 15.0	6.6	23 12.3	1.0	58.0
17	73 35.0	05.6	318 40.6	6.5	23 13.3	0.8	58.0
18	88 35.1	N16 04.9	333 06.1	6.6	S23 14.1	0.7	58.0
19	103 35.2	04.2	347 31.7	6.6	23 14.8	0.6	57.9
20	118 35.2	03.5	1 57.3	6.6	23 15.4	0.4	57.9
21	133 35.3	02.8	16 22.9	6.7	23 15.8	0.2	57.9
22	148 35.4	02.1	30 48.6	6.7	23 16.0	0.2	57.9
23	163 35.5	01.4	45 14.3	6.6	23 16.2	0.1	57.8
9 00	178 35.6	N16 00.6	59 39.9	6.7	S23 16.1	0.1	57.8
01	193 35.7	15 59.9	74 05.6	6.8	23 16.0	0.3	57.8
02	208 35.8	59.2	88 31.4	6.8	23 15.7	0.5	57.8
03	223 35.8	58.5	102 57.2	6.7	23 15.2	0.6	57.8
04	238 35.9	57.8	117 22.9	6.9	23 14.6	0.7	57.7
05	253 36.0	57.1	131 48.8	6.8	23 13.9	0.9	57.7
06	268 36.1	N15 56.4	146 14.6	6.9	S23 13.0	1.0	57.7
07	283 36.2	55.6	160 40.5	6.9	23 12.0	1.2	57.7
T 08	298 36.3	54.9	175 06.4	7.0	23 10.8	1.3	57.7
U 09	313 36.4	54.2	189 32.4	7.0	23 09.5	1.4	57.6
E 10	328 36.4	53.5	203 58.4	7.0	23 08.1	1.6	57.6
S 11	343 36.5	52.8	218 24.4	7.1	23 06.5	1.7	57.6
D 12	358 36.6	N15 52.0	232 50.5	7.1	S23 04.8	1.8	57.6
A 13	13 36.7	51.3	247 16.6	7.1	23 03.0	2.0	57.6
Y 14	28 36.8	50.6	261 42.7	7.2	23 01.0	2.1	57.5
15	43 36.9	49.9	276 08.9	7.3	22 58.9	2.3	57.5
16	58 37.0	49.2	290 35.2	7.2	22 56.6	2.4	57.5
17	73 37.1	48.4	305 01.4	7.4	22 54.2	2.5	57.5
18	88 37.2	N15 47.7	319 27.8	7.3	S22 51.7	2.6	57.5
19	103 37.2	47.0	333 54.1	7.5	22 49.1	2.8	57.4
20	118 37.3	46.3	348 20.6	7.4	22 46.3	3.0	57.4
21	133 37.4	45.6	2 47.0	7.5	22 43.3	3.0	57.4
22	148 37.5	44.8	17 13.5	7.6	22 40.3	3.2	57.4
23	163 37.6	44.1	31 40.1	7.6	22 37.1	3.3	57.3
10 00	178 37.7	N15 43.4	46 06.7	7.7	S22 33.8	3.5	57.3
01	193 37.8	42.7	60 33.4	7.7	22 30.3	3.5	57.3
02	208 37.9	41.9	75 00.1	7.8	22 26.8	3.7	57.3
03	223 38.0	41.2	89 26.9	7.9	22 23.1	3.9	57.3
04	238 38.1	40.5	103 53.8	7.9	22 19.2	3.9	57.2
05	253 38.2	39.7	118 20.7	7.9	22 15.3	4.1	57.2
06	268 38.2	N15 39.0	132 47.6	8.0	S22 11.2	4.2	57.2
W 07	283 38.3	38.3	147 14.6	8.1	22 07.0	4.4	57.2
E 08	298 38.4	37.6	161 41.7	8.1	22 02.6	4.4	57.2
D 09	313 38.5	36.8	176 08.8	8.2	21 58.2	4.6	57.1
N 10	328 38.6	36.1	190 36.0	8.3	21 53.6	4.7	57.1
E 11	343 38.7	35.4	205 03.3	8.3	21 48.9	4.8	57.1
S 12	358 38.8	N15 34.6	219 30.6	8.4	S21 44.1	5.0	57.1
D 13	13 38.9	33.9	233 58.0	8.4	21 39.1	5.0	57.1
A 14	28 39.0	33.2	248 25.4	8.5	21 34.1	5.2	57.0
Y 15	43 39.1	32.5	262 52.9	8.6	21 28.9	5.3	57.0
16	58 39.2	31.7	277 20.5	8.6	21 23.6	5.4	57.0
17	73 39.3	31.0	291 48.1	8.7	21 18.2	5.5	57.0
18	88 39.4	N15 30.3	306 15.8	8.8	S21 12.7	5.7	56.9
19	103 39.5	29.5	320 43.6	8.8	21 07.0	5.7	56.9
20	118 39.6	28.8	335 11.4	8.9	21 01.3	5.9	56.9
21	133 39.7	28.1	349 39.3	9.0	20 55.4	6.0	56.9
22	148 39.8	27.3	4 07.3	9.1	20 49.4	6.1	56.9
23	163 39.9	26.6	18 35.4	9.1	S20 43.3	6.2	56.8
	SD 15.8	d 0.7	SD 15.8		15.7		15.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 8	Moonrise 9	Moonrise 10	Moonrise 11
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	01 31				22 24
N 70	////	////	02 21				20 49
68	////	////	02 52			20 31	20 09
66	////	01 43	03 14	18 54	19 33	19 41	19 41
64	////	02 19	03 32	17 57	18 45	19 09	19 20
62	////	02 44	03 47	17 24	18 14	18 45	19 03
60	01 33	03 04	03 59	16 59	17 51	18 26	18 48
N 58	02 05	03 19	04 09	16 39	17 33	18 10	18 36
56	02 29	03 33	04 18	16 23	17 17	17 57	18 25
54	02 47	03 44	04 26	16 09	17 03	17 45	18 16
52	03 02	03 54	04 34	15 57	16 52	17 34	18 07
50	03 15	04 03	04 40	15 46	16 41	17 25	18 00
45	03 40	04 21	04 54	15 24	16 19	17 06	17 44
N 40	04 00	04 36	05 05	15 06	16 02	16 50	17 30
35	04 15	04 48	05 15	14 51	15 47	16 36	17 19
30	04 28	04 58	05 24	14 38	15 34	16 24	17 09
20	04 48	05 15	05 38	14 15	15 12	16 04	16 52
N 10	05 03	05 29	05 51	13 56	14 53	15 47	16 37
0	05 16	05 41	06 02	13 38	14 35	15 30	16 22
S 10	05 27	05 52	06 14	13 20	14 17	15 14	16 08
20	05 37	06 03	06 26	13 01	13 58	14 56	15 53
30	05 46	06 15	06 39	12 39	13 36	14 36	15 36
35	05 51	06 21	06 47	12 26	13 23	14 24	15 25
40	05 56	06 28	06 56	12 11	13 08	14 10	15 14
45	06 01	06 36	07 07	11 53	12 51	13 54	15 00
S 50	06 07	06 45	07 19	11 32	12 29	13 34	14 43
52	06 09	06 49	07 25	11 21	12 18	13 24	14 35
54	06 11	06 54	07 32	11 09	12 06	13 13	14 26
56	06 14	06 58	07 39	10 56	11 53	13 01	14 16
58	06 17	07 04	07 47	10 40	11 37	12 47	14 05
S 60	06 20	07 10	07 56	10 22	11 18	12 30	13 51

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 8	Moonset 9	Moonset 10	Moonset 11
°	h m	h m	h m	h m	h m	h m	h m
N 72	22 31	////	////				23 01
N 70	21 45	////	////				
68	21 16	23 28	////			23 04	25 13
66	20 54	22 22	////	20 49	22 09	23 54	25 40
64	20 37	21 48	////	21 46	22 56	24 26	00 26
62	20 23	21 24	23 33	22 19	23 26	24 49	00 49
60	20 11	21 05	22 33	22 44	23 49	25 07	01 07
N 58	20 00	20 50	22 02	23 04	24 08	00 08	01 23
56	19 51	20 37	21 40	23 20	24 23	00 23	01 36
54	19 43	20 25	21 22	23 34	24 36	00 36	01 47
52	19 36	20 16	21 07	23 46	24 48	00 48	01 57
50	19 30	20 07	20 55	23 57	24 58	00 58	02 06
45	19 16	19 49	20 30	24 19	00 19	01 20	02 25
N 40	19 05	19 35	20 11	24 37	00 37	01 37	02 40
35	18 56	19 23	19 55	24 53	00 53	01 52	02 53
30	18 47	19 13	19 43	00 10	01 06	02 04	03 04
20	18 33	18 56	19 23	00 32	01 28	02 26	03 24
N 10	18 20	18 42	19 08	00 51	01 47	02 44	03 40
0	18 09	18 30	18 55	01 08	02 06	03 02	03 56
S 10	17 58	18 19	18 45	01 26	02 24	03 19	04 11
20	17 46	18 08	18 35	01 45	02 43	03 37	04 27
30	17 32	17 57	18 25	02 06	03 05	03 59	04 46
35	17 24	17 51	18 21	02 19	03 18	04 11	04 57
40	17 15	17 44	18 16	02 34	03 33	04 25	05 09
45	17 05	17 36	18 11	02 51	03 51	04 42	05 24
S 50	16 52	17 27	18 05	03 13	04 13	05 02	05 42
52	16 47	17 23	18 03	03 23	04 24	05 12	05 50
54	16 40	17 18	18 01	03 35	04 35	05 23	05 59
56	16 33	17 13	17 58	03 48	04 49	05 36	06 10
58	16 25	17 08	17 55	04 03	05 05	05 50	06 22
S 60	16 16	17 02	17 52	04 22	05 24	06 07	06 36

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
8	05 46	05 42	12 06	19 52	07 23	09	72
9	05 38	05 34	12 06	20 48	08 20	10	81
10	05 29	05 25	12 05	21 43	09 16	11	89

UT	ARIES	VENUS −4.0		MARS +1.4		JUPITER −2.5		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
11 00	319 07.0	179 47.7	N17 01.6	223 34.8	N23 45.6	281 21.4	N13 29.3	126 06.1	S 3 02.1
01	334 09.5	194 47.1	17 00.7	238 35.4	45.6	296 23.7	29.3	141 08.4	02.2
02	349 12.0	209 46.4	16 59.8	253 36.1	45.6	311 26.0	29.4	156 10.6	02.3
03	4 14.4	224 45.8	. . 58.9	268 36.8	. . 45.6	326 28.4	. . 29.4	171 12.9	. . 02.3
04	19 16.9	239 45.2	58.0	283 37.4	45.5	341 30.7	29.4	186 15.2	02.4
05	34 19.4	254 44.6	57.2	298 38.1	45.5	356 33.0	29.5	201 17.4	02.5
06	49 21.8	269 43.9	N16 56.3	313 38.7	N23 45.5	11 35.3	N13 29.5	216 19.7	S 3 02.6
07	64 24.3	284 43.3	55.4	328 39.4	45.4	26 37.6	29.6	231 22.0	02.7
T 08	79 26.8	299 42.7	54.5	343 40.0	45.4	41 39.9	29.6	246 24.2	02.8
H 09	94 29.2	314 42.1	. . 53.6	358 40.7	. . 45.4	56 42.2	. . 29.6	261 26.5	. . 02.9
U 10	109 31.7	329 41.4	52.7	13 41.4	45.3	71 44.5	29.7	276 28.8	03.0
R 11	124 34.1	344 40.8	51.8	28 42.0	45.3	86 46.8	29.7	291 31.0	03.1
S 12	139 36.6	359 40.2	N16 50.9	43 42.7	N23 45.2	101 49.2	N13 29.8	306 33.3	S 3 03.2
D 13	154 39.1	14 39.6	50.1	58 43.3	45.2	116 51.5	29.8	321 35.6	03.2
A 14	169 41.5	29 38.9	49.2	73 44.0	45.2	131 53.8	29.8	336 37.8	03.3
Y 15	184 44.0	44 38.3	. . 48.3	88 44.7	. . 45.1	146 56.1	. . 29.9	351 40.1	. . 03.4
16	199 46.5	59 37.7	47.4	103 45.3	45.1	161 58.4	29.9	6 42.4	03.5
17	214 48.9	74 37.1	46.5	118 46.0	45.1	177 00.7	30.0	21 44.6	03.6
18	229 51.4	89 36.4	N16 45.6	133 46.6	N23 45.0	192 03.0	N13 30.0	36 46.9	S 3 03.7
19	244 53.9	104 35.8	44.7	148 47.3	45.0	207 05.3	30.0	51 49.2	03.8
20	259 56.3	119 35.2	43.8	163 48.0	45.0	222 07.7	30.1	66 51.4	03.9
21	274 58.8	134 34.6	. . 42.9	178 48.6	. . 44.9	237 10.0	. . 30.1	81 53.7	. . 04.0
22	290 01.3	149 34.0	42.0	193 49.3	44.9	252 12.3	30.2	96 56.0	04.1
23	305 03.7	164 33.3	41.1	208 49.9	44.8	267 14.6	30.2	111 58.2	04.2
12 00	320 06.2	179 32.7	N16 40.2	223 50.6	N23 44.8	282 16.9	N13 30.2	127 00.5	S 3 04.2
01	335 08.6	194 32.1	39.3	238 51.3	44.8	297 19.2	30.3	142 02.8	04.3
02	350 11.1	209 31.5	38.4	253 51.9	44.7	312 21.6	30.3	157 05.0	04.4
03	5 13.6	224 30.9	. . 37.5	268 52.6	. . 44.7	327 23.9	. . 30.3	172 07.3	. . 04.5
04	20 16.0	239 30.2	36.6	283 53.2	44.6	342 26.2	30.4	187 09.6	04.6
05	35 18.5	254 29.6	35.7	298 53.9	44.6	357 28.5	30.4	202 11.8	04.7
06	50 21.0	269 29.0	N16 34.8	313 54.6	N23 44.6	12 30.8	N13 30.5	217 14.1	S 3 04.8
07	65 23.4	284 28.4	33.9	328 55.2	44.5	27 33.1	30.5	232 16.4	04.9
08	80 25.9	299 27.8	33.0	343 55.9	44.5	42 35.5	30.5	247 18.6	05.0
F 09	95 28.4	314 27.2	. . 32.1	358 56.5	. . 44.4	57 37.8	. . 30.6	262 20.9	. . 05.1
R 10	110 30.8	329 26.6	31.2	13 57.2	44.4	72 40.1	30.6	277 23.1	05.2
I 11	125 33.3	344 25.9	30.3	28 57.9	44.4	87 42.4	30.6	292 25.4	05.3
D 12	140 35.7	359 25.3	N16 29.3	43 58.5	N23 44.3	102 44.7	N13 30.7	307 27.7	S 3 05.3
A 13	155 38.2	14 24.7	28.4	58 59.2	44.3	117 47.1	30.7	322 29.9	05.4
Y 14	170 40.7	29 24.1	27.5	73 59.9	44.2	132 49.4	30.8	337 32.2	05.5
15	185 43.1	44 23.5	. . 26.6	89 00.5	. . 44.2	147 51.7	. . 30.8	352 34.5	. . 05.6
16	200 45.6	59 22.9	25.7	104 01.2	44.1	162 54.0	30.8	7 36.7	05.7
17	215 48.1	74 22.3	24.8	119 01.8	44.1	177 56.3	30.9	22 39.0	05.8
18	230 50.5	89 21.7	N16 23.9	134 02.5	N23 44.0	192 58.7	N13 30.9	37 41.3	S 3 05.9
19	245 53.0	104 21.0	23.0	149 03.2	44.0	208 01.0	30.9	52 43.5	06.0
20	260 55.5	119 20.4	22.0	164 03.8	44.0	223 03.3	31.0	67 45.8	06.1
21	275 57.9	134 19.8	. . 21.1	179 04.5	. . 43.9	238 05.6	. . 31.0	82 48.1	. . 06.2
22	291 00.4	149 19.2	20.2	194 05.2	43.9	253 08.0	31.1	97 50.3	06.3
23	306 02.9	164 18.6	19.3	209 05.8	43.8	268 10.3	31.1	112 52.6	06.4
13 00	321 05.3	179 18.0	N16 18.4	224 06.5	N23 43.8	283 12.6	N13 31.1	127 54.8	S 3 06.4
01	336 07.8	194 17.4	17.5	239 07.2	43.7	298 14.9	31.2	142 57.1	06.5
02	351 10.2	209 16.8	16.5	254 07.8	43.7	313 17.2	31.2	157 59.4	06.6
03	6 12.7	224 16.2	. . 15.6	269 08.5	. . 43.6	328 19.6	. . 31.2	173 01.6	. . 06.7
04	21 15.2	239 15.6	14.7	284 09.2	43.6	343 21.9	31.3	188 03.9	06.8
05	36 17.6	254 15.0	13.8	299 09.8	43.5	358 24.2	31.3	203 06.2	06.9
06	51 20.1	269 14.4	N16 12.8	314 10.5	N23 43.5	13 26.5	N13 31.3	218 08.4	S 3 07.0
07	66 22.6	284 13.8	11.9	329 11.1	43.4	28 28.9	31.4	233 10.7	07.1
S 08	81 25.0	299 13.2	11.0	344 11.8	43.4	43 31.2	31.4	248 12.9	07.2
A 09	96 27.5	314 12.6	. . 10.1	359 12.5	. . 43.3	58 33.5	. . 31.4	263 15.2	. . 07.3
T 10	111 30.0	329 11.9	09.1	14 13.1	43.3	73 35.9	31.5	278 17.5	07.4
U 11	126 32.4	344 11.3	08.2	29 13.8	43.2	88 38.2	31.5	293 19.7	07.5
R 12	141 34.9	359 10.7	N16 07.3	44 14.5	N23 43.2	103 40.5	N13 31.5	308 22.0	S 3 07.6
D 13	156 37.4	14 10.1	06.4	59 15.1	43.1	118 42.8	31.6	323 24.3	07.6
A 14	171 39.8	29 09.5	05.4	74 15.8	43.1	133 45.2	31.6	338 26.5	07.7
Y 15	186 42.3	44 08.9	. . 04.5	89 16.5	. . 43.0	148 47.5	. . 31.6	353 28.8	. . 07.8
16	201 44.7	59 08.3	03.6	104 17.1	43.0	163 49.8	31.7	8 31.0	07.9
17	216 47.2	74 07.7	02.6	119 17.8	42.9	178 52.1	31.7	23 33.3	08.0
18	231 49.7	89 07.1	N16 01.7	134 18.5	N23 42.9	193 54.5	N13 31.8	38 35.6	S 3 08.1
19	246 52.1	104 06.5	16 00.8	149 19.1	42.8	208 56.8	31.8	53 37.8	08.2
20	261 54.6	119 05.9	15 59.8	164 19.8	42.8	223 59.1	31.8	68 40.1	08.3
21	276 57.1	134 05.3	. . 58.9	179 20.5	. . 42.7	239 01.5	. . 31.9	83 42.3	. . 08.4
22	291 59.5	149 04.7	58.0	194 21.1	42.6	254 03.8	31.9	98 44.6	08.5
23	307 02.0	164 04.1	57.0	209 21.8	42.6	269 06.1	31.9	113 46.9	08.6
	h m								
Mer. Pass.	2 39.2	v −0.6	d 0.9	v 0.7	d 0.0	v 2.3	d 0.0	v 2.3	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.3	S40 15.2
Achernar	335 27.4	S57 10.3
Acrux	173 11.3	S63 10.1
Adhara	255 13.9	S28 59.2
Aldebaran	290 51.0	N16 31.9
Alioth	166 22.1	N55 54.0
Alkaid	153 00.0	N49 15.5
Al Na'ir	27 44.8	S46 54.0
Alnilam	275 47.9	S 1 11.6
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.0	N26 40.8
Alpheratz	357 44.6	N29 09.4
Altair	62 09.2	N 8 54.2
Ankaa	353 16.6	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 57.0	N19 07.5
Atria	107 30.5	S69 03.1
Avior	234 19.2	S59 32.8
Bellatrix	278 33.6	N 6 21.6
Betelgeuse	271 02.9	N 7 24.6
Canopus	263 57.1	S52 41.9
Capella	280 36.6	N46 00.4
Deneb	49 31.9	N45 19.5
Denebola	182 35.2	N14 30.5
Diphda	348 57.0	S17 55.1
Dubhe	193 53.8	N61 41.4
Elnath	278 14.5	N28 36.9
Eltanin	90 46.4	N51 29.5
Enif	33 48.1	N 9 55.9
Fomalhaut	15 25.0	S29 33.3
Gacrux	172 02.8	S57 11.0
Gienah	175 53.9	S17 36.5
Hadar	148 50.0	S60 26.0
Hamal	328 02.1	N23 31.1
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 19.9	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.4	N 4 08.2
Menkent	148 09.2	S36 25.8
Miaplacidus	221 41.0	S69 46.0
Mirfak	308 42.3	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.6	S56 41.7
Pollux	243 29.6	N27 59.8
Procyon	245 01.4	N 5 11.7
Rasalhague	96 07.4	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.5	S 8 11.2
Rigil Kent.	139 53.6	S60 53.2
Sabik	102 13.8	S15 44.3
Schedar	349 41.7	N56 36.0
Shaula	96 23.4	S37 06.7
Sirius	258 35.1	S16 43.9
Spica	158 32.8	S11 13.4
Suhail	222 53.9	S43 28.8
Vega	80 39.5	N38 48.0
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	219 26.5	12 02
Mars	263 44.4	9 04
Jupiter	322 10.7	5 10
Saturn	166 54.3	15 30

UT	SUN				MOON					
	GHA		Dec		GHA		v	Dec		d	HP
d h	°	′	°	′	°	′	′	°	′	′	′
11 00	178	40.0	N15	25.9	33	03.5	9.2	S20	37.1	6.3	56.8
01	193	40.1		25.1	47	31.7	9.2	20	30.8	6.4	56.8
02	208	40.2		24.4	61	59.9	9.3	20	24.4	6.5	56.8
03	223	40.3	. .	23.7	76	28.2	9.4	20	17.9	6.6	56.8
04	238	40.4		22.9	90	56.6	9.5	20	11.3	6.8	56.7
05	253	40.4		22.2	105	25.1	9.5	20	04.5	6.8	56.7
06	268	40.5	N15	21.4	119	53.6	9.7	S19	57.7	6.9	56.7
07	283	40.6		20.7	134	22.3	9.6	19	50.8	7.1	56.7
08	298	40.7		20.0	148	50.9	9.8	19	43.7	7.1	56.6
09	313	40.8	. .	19.2	163	19.7	9.8	19	36.6	7.2	56.6
10	328	40.9		18.5	177	48.5	9.9	19	29.4	7.4	56.6
11	343	41.0		17.7	192	17.4	10.0	19	22.0	7.4	56.6
12	358	41.1	N15	17.0	206	46.4	10.0	S19	14.6	7.5	56.6
13	13	41.2		16.3	221	15.4	10.2	19	07.1	7.7	56.5
14	28	41.3		15.5	235	44.6	10.2	18	59.4	7.7	56.5
15	43	41.4	. .	14.8	250	13.8	10.2	18	51.7	7.8	56.5
16	58	41.5		14.0	264	43.0	10.4	18	43.9	7.9	56.5
17	73	41.6		13.3	279	12.4	10.4	18	36.0	8.0	56.5
18	88	41.8	N15	12.6	293	41.8	10.5	S18	28.0	8.1	56.4
19	103	41.9		11.8	308	11.3	10.6	18	19.9	8.1	56.4
20	118	42.0		11.1	322	40.9	10.6	18	11.8	8.3	56.4
21	133	42.1	. .	10.3	337	10.5	10.7	18	03.5	8.3	56.4
22	148	42.2		09.6	351	40.2	10.8	17	55.2	8.4	56.4
23	163	42.3		08.8	6	10.0	10.9	17	46.8	8.6	56.3
12 00	178	42.4	N15	08.1	20	39.9	10.9	S17	38.2	8.5	56.3
01	193	42.5		07.3	35	09.8	11.0	17	29.7	8.7	56.3
02	208	42.6		06.6	49	39.8	11.1	17	21.0	8.8	56.3
03	223	42.7	. .	05.9	64	09.9	11.1	17	12.2	8.8	56.3
04	238	42.8		05.1	78	40.0	11.3	17	03.4	8.9	56.2
05	253	42.9		04.4	93	10.3	11.3	16	54.5	9.0	56.2
06	268	43.0	N15	03.6	107	40.6	11.3	S16	45.5	9.1	56.2
07	283	43.1		02.9	122	10.9	11.5	16	36.4	9.1	56.2
08	298	43.2		02.1	136	41.4	11.5	16	27.3	9.2	56.2
09	313	43.3	. .	01.4	151	11.9	11.6	16	18.1	9.3	56.1
10	328	43.4	15	00.6	165	42.5	11.7	16	08.8	9.4	56.1
11	343	43.5	14	59.9	180	13.2	11.7	15	59.4	9.4	56.1
12	358	43.6	N14	59.1	194	43.9	11.8	S15	50.0	9.5	56.1
13	13	43.7		58.4	209	14.7	11.9	15	40.5	9.6	56.0
14	28	43.8		57.6	223	45.6	11.9	15	30.9	9.6	56.0
15	43	43.9	. .	56.9	238	16.5	12.0	15	21.3	9.8	56.0
16	58	44.0		56.1	252	47.5	12.1	15	11.5	9.7	56.0
17	73	44.2		55.4	267	18.6	12.2	15	01.8	9.9	56.0
18	88	44.3	N14	54.6	281	49.8	12.2	S14	51.9	9.9	55.9
19	103	44.4		53.9	296	21.0	12.3	14	42.0	9.9	55.9
20	118	44.5		53.1	310	52.3	12.4	14	32.1	10.0	55.9
21	133	44.6	. .	52.4	325	23.7	12.4	14	22.1	10.1	55.9
22	148	44.7		51.6	339	55.1	12.5	14	12.0	10.2	55.9
23	163	44.8		50.8	354	26.6	12.6	14	01.8	10.2	55.8
13 00	178	44.9	N14	50.1	8	58.2	12.6	S13	51.6	10.2	55.8
01	193	45.0		49.3	23	29.8	12.7	13	41.4	10.3	55.8
02	208	45.1		48.6	38	01.5	12.8	13	31.1	10.4	55.8
03	223	45.2	. .	47.8	52	33.3	12.8	13	20.7	10.4	55.8
04	238	45.4		47.1	67	05.1	12.9	13	10.3	10.5	55.7
05	253	45.5		46.3	81	37.0	12.9	12	59.8	10.5	55.7
06	268	45.6	N14	45.6	96	08.9	13.1	S12	49.3	10.6	55.7
07	283	45.7		44.8	110	41.0	13.0	12	38.7	10.6	55.7
08	298	45.8		44.0	125	13.0	13.2	12	28.1	10.7	55.7
09	313	45.9	. .	43.3	139	45.2	13.2	12	17.4	10.7	55.6
10	328	46.0		42.5	154	17.4	13.3	12	06.7	10.8	55.6
11	343	46.1		41.8	168	49.7	13.3	11	55.9	10.8	55.6
12	358	46.2	N14	41.0	183	22.0	13.4	S11	45.1	10.9	55.6
13	13	46.4		40.2	197	54.4	13.4	11	34.2	10.9	55.6
14	28	46.5		39.5	212	26.8	13.6	11	23.3	10.9	55.6
15	43	46.6	. .	38.7	226	59.4	13.5	11	12.4	11.0	55.5
16	58	46.7		38.0	241	31.9	13.6	11	01.4	11.1	55.5
17	73	46.8		37.2	256	04.5	13.7	10	50.3	11.0	55.5
18	88	46.9	N14	36.4	270	37.2	13.8	S10	39.3	11.1	55.5
19	103	47.0		35.7	285	10.0	13.8	10	28.2	11.2	55.5
20	118	47.1		34.9	299	42.8	13.8	10	17.0	11.2	55.4
21	133	47.3	. .	34.1	314	15.6	13.9	10	05.8	11.2	55.4
22	148	47.4		33.4	328	48.5	14.0	9	54.6	11.2	55.4
23	163	47.5		32.6	343	21.5	14.0	S 9	43.4	11.3	55.4
	SD	15.8	d	0.8	SD		15.4		15.3		15.1

THURSDAY

FRIDAY

SATURDAY

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 11	Moonrise 12	Moonrise 13	Moonrise 14
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	01 59	22 24	20 49	20 18	19 56
N 70	////	////	02 38	20 49	20 20	20 02	19 48
68	////	01 12	03 05	20 09	19 58	19 49	19 42
66	////	02 02	03 25	19 41	19 40	19 39	19 36
64	////	02 33	03 41	19 20	19 26	19 30	19 32
62	01 04	02 55	03 55	19 03	19 14	19 22	19 28
60	01 49	03 13	04 06	18 48	19 04	19 15	19 24
N 58	02 17	03 27	04 16	18 36	18 55	19 09	19 21
56	02 38	03 40	04 24	18 25	18 47	19 04	19 18
54	02 55	03 50	04 32	18 16	18 40	18 59	19 15
52	03 09	04 00	04 38	18 07	18 33	18 55	19 13
50	03 21	04 08	04 45	18 00	18 28	18 51	19 11
45	03 45	04 25	04 58	17 44	18 15	18 42	19 06
N 40	04 03	04 39	05 08	17 30	18 05	18 35	19 02
35	04 18	04 50	05 17	17 19	17 56	18 29	18 59
30	04 30	05 00	05 25	17 09	17 48	18 24	18 56
20	04 49	05 16	05 39	16 52	17 35	18 14	18 51
N 10	05 03	05 29	05 51	16 37	17 23	18 06	18 46
0	05 15	05 40	06 02	16 22	17 12	17 58	18 42
S 10	05 26	05 51	06 13	16 08	17 00	17 50	18 38
20	05 35	06 01	06 24	15 53	16 48	17 42	18 33
30	05 44	06 12	06 37	15 36	16 35	17 32	18 28
35	05 48	06 18	06 44	15 25	16 27	17 26	18 25
40	05 52	06 25	06 53	15 14	16 18	17 20	18 21
45	05 57	06 32	07 02	15 00	16 07	17 13	18 17
S 50	06 02	06 40	07 14	14 43	15 54	17 04	18 12
52	06 04	06 44	07 20	14 35	15 48	17 00	18 10
54	06 06	06 48	07 26	14 26	15 41	16 55	18 08
56	06 08	06 52	07 32	14 16	15 33	16 50	18 05
58	06 11	06 57	07 40	14 05	15 25	16 44	18 02
S 60	06 13	07 03	07 48	13 51	15 15	16 38	17 59

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 11	Moonset 12	Moonset 13	Moonset 14
°	h m	h m	h m	h m	h m	h m	h m
N 72	22 05	////	////	23 01	26 16	02 16	04 22
N 70	21 28	////	////	▬	00 34	02 44	04 36
68	21 02	22 49	////	25 13	01 13	03 05	04 48
66	20 42	22 03	////	25 40	01 40	03 21	04 57
64	20 27	21 34	////	00 26	02 01	03 34	05 04
62	20 14	21 12	22 57	00 49	02 17	03 45	05 11
60	20 03	20 55	22 16	01 07	02 31	03 55	05 17
N 58	19 53	20 41	21 50	01 23	02 43	04 03	05 22
56	19 45	20 29	21 29	01 36	02 53	04 10	05 26
54	19 37	20 18	21 13	01 47	03 02	04 17	05 30
52	19 31	20 09	20 59	01 57	03 10	04 22	05 34
50	19 25	20 01	20 48	02 06	03 17	04 27	05 37
45	19 12	19 44	20 24	02 25	03 32	04 39	05 44
N 40	19 01	19 31	20 06	02 40	03 44	04 48	05 50
35	18 52	19 19	19 52	02 53	03 55	04 56	05 55
30	18 44	19 10	19 40	03 04	04 04	05 02	05 59
20	18 31	18 54	19 21	03 24	04 20	05 14	06 07
N 10	18 19	18 41	19 07	03 40	04 34	05 25	06 13
0	18 09	18 30	18 55	03 56	04 46	05 34	06 19
S 10	17 58	18 19	18 45	04 11	04 59	05 44	06 25
20	17 46	18 09	18 35	04 27	05 13	05 54	06 32
30	17 34	17 58	18 27	04 46	05 28	06 05	06 39
35	17 26	17 53	18 23	04 57	05 37	06 12	06 43
40	17 18	17 46	18 18	05 09	05 47	06 19	06 48
45	17 08	17 39	18 14	05 24	05 59	06 28	06 53
S 50	16 57	17 31	18 09	05 42	06 13	06 38	07 00
52	16 51	17 27	18 07	05 50	06 19	06 43	07 03
54	16 45	17 23	18 05	05 59	06 27	06 48	07 06
56	16 39	17 19	18 03	06 10	06 35	06 54	07 10
58	16 31	17 14	18 00	06 22	06 44	07 01	07 14
S 60	16 23	17 08	17 58	06 36	06 54	07 08	07 18

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
11	05 20	05 16	12 05	22 34	10 09	12	95
12	05 11	05 06	12 05	23 23	10 59	13	98
13	05 01	04 55	12 05	24 09	11 46	14	100

UT	ARIES	VENUS −4.0		MARS +1.4		JUPITER −2.5		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
14 00	322 04.5	179 03.6	N15 56.1	224 22.5	N23 42.5	284 08.5	N13 32.0	128 49.1	S 3 08.7
01	337 06.9	194 03.0	55.2	239 23.1	42.5	299 10.8	32.0	143 51.4	08.8
02	352 09.4	209 02.4	54.2	254 23.8	42.4	314 13.1	32.0	158 53.7	08.9
03	7 11.8	224 01.8	. . 53.3	269 24.5	. . 42.4	329 15.4	. . 32.1	173 55.9	. . 08.9
04	22 14.3	239 01.2	52.3	284 25.2	42.3	344 17.8	32.1	188 58.2	09.0
05	37 16.8	254 00.6	51.4	299 25.8	42.3	359 20.1	32.1	204 00.4	09.1
06	52 19.2	269 00.0	N15 50.5	314 26.5	N23 42.2	14 22.4	N13 32.2	219 02.7	S 3 09.2
07	67 21.7	283 59.4	49.5	329 27.2	42.1	29 24.8	32.2	234 05.0	09.3
08	82 24.2	298 58.8	48.6	344 27.8	42.1	44 27.1	32.2	249 07.2	09.4
S 09	97 26.6	313 58.2	. . 47.6	359 28.5	. . 42.0	59 29.4	. . 32.2	264 09.5	. . 09.5
U 10	112 29.1	328 57.6	46.7	14 29.2	42.0	74 31.8	32.3	279 11.7	09.6
N 11	127 31.6	343 57.0	45.7	29 29.8	41.9	89 34.1	32.3	294 14.0	09.7
D 12	142 34.0	358 56.4	N15 44.8	44 30.5	N23 41.9	104 36.4	N13 32.3	309 16.3	S 3 09.8
A 13	157 36.5	13 55.8	43.8	59 31.2	41.8	119 38.8	32.4	324 18.5	09.9
Y 14	172 39.0	28 55.2	42.9	74 31.8	41.7	134 41.1	32.4	339 20.8	10.0
15	187 41.4	43 54.7	. . 41.9	89 32.5	. . 41.7	149 43.5	. . 32.4	354 23.0	. . 10.1
16	202 43.9	58 54.1	41.0	104 33.2	41.6	164 45.8	32.5	9 25.3	10.2
17	217 46.3	73 53.5	40.0	119 33.9	41.6	179 48.1	32.5	24 27.5	10.3
18	232 48.8	88 52.9	N15 39.1	134 34.5	N23 41.5	194 50.5	N13 32.5	39 29.8	S 3 10.3
19	247 51.3	103 52.3	38.1	149 35.2	41.4	209 52.8	32.6	54 32.1	10.4
20	262 53.7	118 51.7	37.2	164 35.9	41.4	224 55.1	32.6	69 34.3	10.5
21	277 56.2	133 51.1	. . 36.2	179 36.5	. . 41.3	239 57.5	. . 32.6	84 36.6	. . 10.6
22	292 58.7	148 50.5	35.3	194 37.2	41.2	254 59.8	32.7	99 38.8	10.7
23	308 01.1	163 50.0	34.3	209 37.9	41.2	270 02.2	32.7	114 41.1	10.8
15 00	323 03.6	178 49.4	N15 33.4	224 38.6	N23 41.1	285 04.5	N13 32.7	129 43.4	S 3 10.9
01	338 06.1	193 48.8	32.4	239 39.2	41.1	300 06.8	32.8	144 45.6	11.0
02	353 08.5	208 48.2	31.5	254 39.9	41.0	315 09.2	32.8	159 47.9	11.1
03	8 11.0	223 47.6	. . 30.5	269 40.6	. . 40.9	330 11.5	. . 32.8	174 50.1	. . 11.2
04	23 13.5	238 47.0	29.5	284 41.2	40.9	345 13.8	32.8	189 52.4	11.3
05	38 15.9	253 46.4	28.6	299 41.9	40.8	0 16.2	32.9	204 54.6	11.4
06	53 18.4	268 45.9	N15 27.6	314 42.6	N23 40.7	15 18.5	N13 32.9	219 56.9	S 3 11.5
07	68 20.8	283 45.3	26.7	329 43.3	40.7	30 20.9	32.9	234 59.2	11.6
08	83 23.3	298 44.7	25.7	344 43.9	40.6	45 23.2	33.0	250 01.4	11.7
M 09	98 25.8	313 44.1	. . 24.7	359 44.6	. . 40.5	60 25.5	. . 33.0	265 03.7	. . 11.8
O 10	113 28.2	328 43.5	23.8	14 45.3	40.5	75 27.9	33.0	280 05.9	11.9
N 11	128 30.7	343 43.0	22.8	29 45.9	40.4	90 30.2	33.1	295 08.2	11.9
D 12	143 33.2	358 42.4	N15 21.9	44 46.6	N23 40.3	105 32.6	N13 33.1	310 10.4	S 3 12.0
A 13	158 35.6	13 41.8	20.9	59 47.3	40.3	120 34.9	33.1	325 12.7	12.1
Y 14	173 38.1	28 41.2	19.9	74 48.0	40.2	135 37.3	33.1	340 15.0	12.2
15	188 40.6	43 40.6	. . 19.0	89 48.6	. . 40.1	150 39.6	. . 33.2	355 17.2	. . 12.3
16	203 43.0	58 40.1	18.0	104 49.3	40.1	165 41.9	33.2	10 19.5	12.4
17	218 45.5	73 39.5	17.0	119 50.0	40.0	180 44.3	33.2	25 21.7	12.5
18	233 47.9	88 38.9	N15 16.1	134 50.7	N23 39.9	195 46.6	N13 33.3	40 24.0	S 3 12.6
19	248 50.4	103 38.3	15.1	149 51.3	39.9	210 49.0	33.3	55 26.2	12.7
20	263 52.9	118 37.8	14.1	164 52.0	39.8	225 51.3	33.3	70 28.5	12.8
21	278 55.3	133 37.2	. . 13.1	179 52.7	. . 39.7	240 53.7	. . 33.3	85 30.8	. . 12.9
22	293 57.8	148 36.6	12.2	194 53.4	39.7	255 56.0	33.4	100 33.0	13.0
23	309 00.3	163 36.0	11.2	209 54.0	39.6	270 58.4	33.4	115 35.3	13.1
16 00	324 02.7	178 35.4	N15 10.2	224 54.7	N23 39.5	286 00.7	N13 33.4	130 37.5	S 3 13.2
01	339 05.2	193 34.9	09.3	239 55.4	39.4	301 03.1	33.5	145 39.8	13.3
02	354 07.7	208 34.3	08.3	254 56.1	39.4	316 05.4	33.5	160 42.0	13.4
03	9 10.1	223 33.7	. . 07.3	269 56.7	. . 39.3	331 07.7	. . 33.5	175 44.3	. . 13.5
04	24 12.6	238 33.2	06.3	284 57.4	39.2	346 10.1	33.5	190 46.5	13.6
05	39 15.1	253 32.6	05.4	299 58.1	39.2	1 12.4	33.6	205 48.8	13.6
06	54 17.5	268 32.0	N15 04.4	314 58.8	N23 39.1	16 14.8	N13 33.6	220 51.1	S 3 13.7
07	69 20.0	283 31.4	03.4	329 59.4	39.0	31 17.1	33.6	235 53.3	13.8
T 08	84 22.4	298 30.9	02.4	345 00.1	38.9	46 19.5	33.7	250 55.6	13.9
U 09	99 24.9	313 30.3	. . 01.4	0 00.8	. . 38.9	61 21.8	. . 33.7	265 57.8	. . 14.0
E 10	114 27.4	328 29.7	15 00.5	15 01.5	38.8	76 24.2	33.7	281 00.1	14.1
S 11	129 29.8	343 29.2	14 59.5	30 02.2	38.7	91 26.5	33.7	296 02.3	14.2
D 12	144 32.3	358 28.6	N14 58.5	45 02.8	N23 38.6	106 28.9	N13 33.8	311 04.6	S 3 14.3
A 13	159 34.8	13 28.0	57.5	60 03.5	38.6	121 31.2	33.8	326 06.8	14.4
Y 14	174 37.2	28 27.5	56.5	75 04.2	38.5	136 33.6	33.8	341 09.1	14.5
15	189 39.7	43 26.9	. . 55.5	90 04.9	. . 38.4	151 35.9	. . 33.8	356 11.4	. . 14.6
16	204 42.2	58 26.3	54.6	105 05.5	38.3	166 38.3	33.9	11 13.6	14.7
17	219 44.6	73 25.7	53.6	120 06.2	38.3	181 40.6	33.9	26 15.9	14.8
18	234 47.1	88 25.2	N14 52.6	135 06.9	N23 38.2	196 43.0	N13 33.9	41 18.1	S 3 14.9
19	249 49.5	103 24.6	51.6	150 07.6	38.1	211 45.3	34.0	56 20.4	15.0
20	264 52.0	118 24.0	50.6	165 08.3	38.0	226 47.7	34.0	71 22.6	15.1
21	279 54.5	133 23.5	. . 49.6	180 08.9	. . 37.9	241 50.0	. . 34.0	86 24.9	. . 15.2
22	294 56.9	148 22.9	48.6	195 09.6	37.9	256 52.4	34.0	101 27.1	15.3
23	309 59.4	163 22.4	47.7	210 10.3	37.8	271 54.8	34.1	116 29.4	15.4
Mer. Pass.	h m 2 27.4	v −0.6	d 1.0	v 0.7	d 0.1	v 2.3	d 0.0	v 2.3	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.2	S40 15.2
Achernar	335 27.4	S57 10.3
Acrux	173 11.3	S63 10.1
Adhara	255 13.8	S28 59.2
Aldebaran	290 51.0	N16 31.9
Alioth	166 22.1	N55 54.0
Alkaid	153 00.0	N49 15.5
Al Na'ir	27 44.8	S46 54.0
Alnilam	275 47.8	S 1 11.6
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.1	N26 40.8
Alpheratz	357 44.6	N29 09.4
Altair	62 09.2	N 8 54.2
Ankaa	353 16.6	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 57.0	N19 07.5
Atria	107 30.5	S69 03.1
Avior	234 19.2	S59 32.8
Bellatrix	278 33.5	N 6 21.6
Betelgeuse	271 02.9	N 7 24.6
Canopus	263 57.1	S52 41.9
Capella	280 36.6	N46 00.4
Deneb	49 31.9	N45 19.5
Denebola	182 35.2	N14 30.5
Diphda	348 56.9	S17 55.1
Dubhe	193 53.8	N61 41.3
Elnath	278 14.4	N28 36.9
Eltanin	90 46.4	N51 29.6
Enif	33 48.1	N 9 55.9
Fomalhaut	15 25.0	S29 33.3
Gacrux	172 02.8	S57 10.9
Gienah	175 53.9	S17 36.5
Hadar	148 50.0	S60 26.0
Hamal	328 02.1	N23 31.1
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 20.0	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.4	N 4 08.2
Menkent	148 09.2	S36 25.8
Miaplacidus	221 41.0	S69 46.0
Mirfak	308 42.2	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.6	S56 41.7
Pollux	243 29.6	N27 59.8
Procyon	245 01.4	N 5 11.7
Rasalhague	96 07.5	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.4	S 8 11.2
Rigil Kent.	139 53.7	S60 53.2
Sabik	102 13.9	S15 44.3
Schedar	349 41.7	N56 36.0
Shaula	96 23.4	S37 06.7
Sirius	258 35.1	S16 43.8
Spica	158 32.8	S11 13.4
Suhail	222 53.9	S43 28.8
Vega	80 39.5	N38 48.0
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	215 45.8	12 05
Mars	261 35.0	9 01
Jupiter	322 00.9	4 59
Saturn	166 39.8	15 19

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
14 00	178 47.6	N14 31.8	357 54.5	14.0	S 9 32.1	11.4	55.4
01	193 47.7	31.1	12 27.5	14.1	9 20.7	11.3	55.3
02	208 47.8	30.3	27 00.6	14.2	9 09.4	11.4	55.3
03	223 47.9	29.6	41 33.8	14.2	8 58.0	11.4	55.3
04	238 48.1	28.8	56 07.0	14.3	8 46.6	11.5	55.3
05	253 48.2	28.0	70 40.3	14.3	8 35.1	11.4	55.3
06	268 48.3	N14 27.3	85 13.6	14.4	S 8 23.7	11.5	55.3
07	283 48.4	26.5	99 47.0	14.4	8 12.2	11.6	55.2
08	298 48.5	25.7	114 20.4	14.4	8 00.6	11.5	55.2
S 09	313 48.6	24.9	128 53.8	14.5	7 49.1	11.6	55.2
U 10	328 48.8	24.2	143 27.3	14.6	7 37.5	11.6	55.2
N 11	343 48.9	23.4	158 00.9	14.6	7 25.9	11.6	55.2
D 12	358 49.0	N14 22.6	172 34.5	14.6	S 7 14.3	11.7	55.1
A 13	13 49.1	21.9	187 08.1	14.7	7 02.6	11.6	55.1
Y 14	28 49.2	21.1	201 41.8	14.7	6 51.0	11.7	55.1
15	43 49.4	20.3	216 15.5	14.8	6 39.3	11.7	55.1
16	58 49.5	19.6	230 49.3	14.8	6 27.6	11.8	55.1
17	73 49.6	18.8	245 23.1	14.8	6 15.8	11.7	55.1
18	88 49.7	N14 18.0	259 56.9	14.9	S 6 04.1	11.8	55.0
19	103 49.8	17.2	274 30.8	14.9	5 52.3	11.7	55.0
20	118 49.9	16.5	289 04.7	15.0	5 40.6	11.8	55.0
21	133 50.1	15.7	303 38.7	15.0	5 28.8	11.8	55.0
22	148 50.2	14.9	318 12.7	15.0	5 17.0	11.9	55.0
23	163 50.3	14.1	332 46.7	15.1	5 05.1	11.8	55.0
15 00	178 50.4	N14 13.4	347 20.8	15.1	S 4 53.3	11.9	54.9
01	193 50.5	12.6	1 54.9	15.1	4 41.4	11.8	54.9
02	208 50.7	11.8	16 29.0	15.2	4 29.6	11.9	54.9
03	223 50.8	11.0	31 03.2	15.2	4 17.7	11.9	54.9
04	238 50.9	10.3	45 37.4	15.2	4 05.8	11.8	54.9
05	253 51.0	09.5	60 11.6	15.3	3 54.0	11.9	54.9
06	268 51.2	N14 08.7	74 45.9	15.3	S 3 42.1	11.9	54.8
07	283 51.3	07.9	89 20.2	15.3	3 30.2	12.0	54.8
08	298 51.4	07.2	103 54.5	15.3	3 18.2	11.9	54.8
M 09	313 51.5	06.4	118 28.8	15.4	3 06.3	11.9	54.8
O 10	328 51.6	05.6	133 03.2	15.4	2 54.4	11.9	54.8
N 11	343 51.8	04.8	147 37.6	15.4	2 42.5	11.9	54.8
D 12	358 51.9	N14 04.1	162 12.0	15.5	S 2 30.6	12.0	54.8
A 13	13 52.0	03.3	176 46.5	15.5	2 18.6	11.9	54.7
Y 14	28 52.1	02.5	191 21.0	15.5	2 06.7	11.9	54.7
15	43 52.3	01.7	205 55.5	15.5	1 54.8	12.0	54.7
16	58 52.4	00.9	220 30.0	15.6	1 42.8	11.9	54.7
17	73 52.5	14 00.2	235 04.6	15.5	1 30.9	11.9	54.7
18	88 52.6	N13 59.4	249 39.1	15.6	S 1 19.0	11.9	54.7
19	103 52.8	58.6	264 13.7	15.6	1 07.1	12.0	54.6
20	118 52.9	57.8	278 48.3	15.6	0 55.1	11.9	54.6
21	133 53.0	57.0	293 22.9	15.7	0 43.2	11.9	54.6
22	148 53.1	56.2	307 57.6	15.7	0 31.3	11.9	54.6
23	163 53.3	55.5	322 32.3	15.6	0 19.4	11.9	54.6
16 00	178 53.4	N13 54.7	337 06.9	15.7	S 0 07.5	11.9	54.6
01	193 53.5	53.9	351 41.6	15.7	N 0 04.4	11.9	54.6
02	208 53.6	53.1	6 16.3	15.8	0 16.3	11.9	54.6
03	223 53.8	52.3	20 51.1	15.7	0 28.2	11.9	54.5
04	238 53.9	51.5	35 25.8	15.7	0 40.1	11.9	54.5
05	253 54.0	50.8	50 00.5	15.8	0 52.0	11.8	54.5
06	268 54.1	N13 50.0	64 35.3	15.8	N 1 03.8	11.9	54.5
07	283 54.3	49.2	79 10.1	15.8	1 15.7	11.8	54.5
T 08	298 54.4	48.4	93 44.9	15.7	1 27.5	11.8	54.5
U 09	313 54.5	47.6	108 19.6	15.8	1 39.3	11.8	54.5
E 10	328 54.7	46.8	122 54.4	15.9	1 51.1	11.8	54.5
S 11	343 54.8	46.0	137 29.3	15.8	2 02.9	11.8	54.4
D 12	358 54.9	N13 45.2	152 04.1	15.8	N 2 14.7	11.8	54.4
A 13	13 55.0	44.5	166 38.9	15.8	2 26.5	11.7	54.4
Y 14	28 55.2	43.7	181 13.7	15.8	2 38.2	11.8	54.4
15	43 55.3	42.9	195 48.5	15.9	2 50.0	11.7	54.4
16	58 55.4	42.1	210 23.4	15.8	3 01.7	11.7	54.4
17	73 55.6	41.3	224 58.2	15.8	3 13.4	11.7	54.4
18	88 55.7	N13 40.5	239 33.0	15.9	N 3 25.1	11.7	54.4
19	103 55.8	39.7	254 07.9	15.8	3 36.8	11.6	54.4
20	118 56.0	38.9	268 42.7	15.9	3 48.4	11.6	54.3
21	133 56.1	38.1	283 17.6	15.8	4 00.0	11.6	54.3
22	148 56.2	37.3	297 52.4	15.8	4 11.6	11.6	54.3
23	163 56.3	36.5	312 27.2	15.9	N 4 23.2	11.6	54.3
	SD 15.8	d 0.8	SD	15.0		14.9		14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 14	Moonrise 15	Moonrise 16	Moonrise 17
	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	02 22	19 56	19 38	19 20	19 00
N 70	////	////	02 54	19 48	19 36	19 24	19 12
68	////	01 40	03 18	19 42	19 35	19 28	19 22
66	////	02 19	03 36	19 36	19 34	19 32	19 30
64	////	02 45	03 51	19 32	19 33	19 35	19 36
62	01 29	03 05	04 03	19 28	19 32	19 37	19 42
60	02 04	03 21	04 13	19 24	19 32	19 39	19 47
N 58	02 28	03 35	04 22	19 21	19 31	19 41	19 52
56	02 47	03 46	04 30	19 18	19 31	19 43	19 56
54	03 03	03 56	04 37	19 15	19 30	19 45	20 00
52	03 16	04 05	04 43	19 13	19 30	19 46	20 03
50	03 27	04 13	04 49	19 11	19 29	19 47	20 06
45	03 50	04 29	05 01	19 06	19 29	19 50	20 13
N 40	04 07	04 42	05 11	19 02	19 28	19 53	20 18
35	04 21	04 53	05 20	18 59	19 27	19 55	20 23
30	04 32	05 02	05 27	18 56	19 27	19 57	20 27
20	04 50	05 17	05 40	18 51	19 26	20 00	20 35
N 10	05 04	05 29	05 51	18 46	19 25	20 03	20 41
0	05 15	05 40	06 01	18 42	19 24	20 06	20 47
S 10	05 25	05 50	06 11	18 38	19 23	20 08	20 53
20	05 33	05 59	06 22	18 33	19 23	20 11	21 00
30	05 41	06 09	06 34	18 28	19 22	20 15	21 08
35	05 45	06 15	06 41	18 25	19 21	20 17	21 12
40	05 49	06 21	06 49	18 21	19 21	20 19	21 17
45	05 53	06 27	06 58	18 17	19 20	20 22	21 23
S 50	05 57	06 35	07 09	18 12	19 19	20 25	21 30
52	05 59	06 38	07 14	18 10	19 19	20 26	21 34
54	06 00	06 42	07 19	18 08	19 18	20 28	21 37
56	06 02	06 46	07 26	18 05	19 18	20 30	21 41
58	06 04	06 51	07 33	18 02	19 18	20 32	21 46
S 60	06 06	06 56	07 40	17 59	19 17	20 34	21 51

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 14	Moonset 15	Moonset 16	Moonset 17
°	h m	h m	h m	h m	h m	h m	h m
N 72	21 42	////	////	04 22	06 15	08 02	09 48
N 70	21 11	23 43	////	04 36	06 20	08 00	09 39
68	20 48	22 22	////	04 48	06 25	07 58	09 31
66	20 31	21 46	////	04 57	06 28	07 57	09 25
64	20 16	21 21	23 45	05 04	06 31	07 56	09 19
62	20 04	21 01	22 34	05 11	06 34	07 55	09 15
60	19 54	20 45	22 01	05 17	06 36	07 54	09 11
N 58	19 45	20 32	21 38	05 22	06 38	07 53	09 07
56	19 38	20 21	21 19	05 26	06 40	07 53	09 04
54	19 31	20 11	21 04	05 30	06 42	07 52	09 01
52	19 25	20 03	20 51	05 34	06 43	07 51	08 59
50	19 19	19 55	20 41	05 37	06 45	07 51	08 56
45	19 07	19 39	20 18	05 44	06 48	07 50	08 51
N 40	18 57	19 26	20 01	05 50	06 50	07 49	08 47
35	18 49	19 16	19 48	05 55	06 52	07 48	08 44
30	18 42	19 07	19 37	05 59	06 54	07 47	08 40
20	18 29	18 52	19 19	06 07	06 57	07 46	08 35
N 10	18 18	18 40	19 05	06 13	07 00	07 45	08 30
0	18 08	18 29	18 54	06 19	07 02	07 44	08 26
S 10	17 58	18 20	18 44	06 25	07 05	07 43	08 21
20	17 47	18 10	18 36	06 32	07 08	07 42	08 16
30	17 35	18 00	18 28	06 39	07 11	07 41	08 11
35	17 29	17 55	18 24	06 43	07 12	07 40	08 08
40	17 21	17 49	18 21	06 48	07 14	07 39	08 04
45	17 12	17 42	18 17	06 53	07 16	07 38	08 00
S 50	17 01	17 35	18 13	07 00	07 19	07 37	07 55
52	16 56	17 31	18 11	07 03	07 20	07 37	07 53
54	16 50	17 28	18 09	07 06	07 22	07 36	07 51
56	16 44	17 24	18 08	07 10	07 23	07 35	07 48
58	16 37	17 19	18 06	07 14	07 25	07 35	07 45
S 60	16 30	17 15	18 04	07 18	07 26	07 34	07 42

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
14	04 50	04 44	12 05	00 09	12 31	15	99
15	04 39	04 33	12 05	00 52	13 13	16	97
16	04 27	04 21	12 04	01 34	13 55	17	93

UT	ARIES	VENUS −4.0		MARS +1.4		JUPITER −2.6		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
17 00	325 01.9	178 21.8	N14 46.7	225 11.0	N23 37.7	286 57.1	N13 34.1	131 31.6	S 3 15.5
01	340 04.3	193 21.2	45.7	240 11.6	37.6	301 59.5	34.1	146 33.9	15.6
02	355 06.8	208 20.7	44.7	255 12.3	37.6	317 01.8	34.1	161 36.1	15.6
03	10 09.3	223 20.1	43.7	270 13.0	37.5	332 04.2	34.2	176 38.4	15.7
04	25 11.7	238 19.5	42.7	285 13.7	37.4	347 06.5	34.2	191 40.6	15.8
05	40 14.2	253 19.0	41.7	300 14.4	37.3	2 08.9	34.2	206 42.9	15.9
06	55 16.7	268 18.4	N14 40.7	315 15.0	N23 37.2	17 11.2	N13 34.2	221 45.2	S 3 16.0
W 07	70 19.1	283 17.9	39.7	330 15.7	37.2	32 13.6	34.3	236 47.4	16.1
E 08	85 21.6	298 17.3	38.7	345 16.4	37.1	47 15.9	34.3	251 49.7	16.2
D 09	100 24.0	313 16.7	37.7	0 17.1	37.0	62 18.3	34.3	266 51.9	16.3
N 10	115 26.5	328 16.2	36.7	15 17.8	36.9	77 20.7	34.3	281 54.2	16.4
E 11	130 29.0	343 15.6	35.7	30 18.4	36.8	92 23.0	34.4	296 56.4	16.5
S 12	145 31.4	358 15.1	N14 34.7	45 19.1	N23 36.7	107 25.4	N13 34.4	311 58.7	S 3 16.6
D 13	160 33.9	13 14.5	33.7	60 19.8	36.7	122 27.7	34.4	327 00.9	16.7
A 14	175 36.4	28 13.9	32.7	75 20.5	36.6	137 30.1	34.4	342 03.2	16.8
Y 15	190 38.8	43 13.4	31.7	90 21.2	36.5	152 32.5	34.5	357 05.4	16.9
16	205 41.3	58 12.8	30.7	105 21.9	36.4	167 34.8	34.5	12 07.7	17.0
17	220 43.8	73 12.3	29.7	120 22.5	36.3	182 37.2	34.5	27 09.9	17.1
18	235 46.2	88 11.7	N14 28.7	135 23.2	N23 36.2	197 39.5	N13 34.5	42 12.2	S 3 17.2
19	250 48.7	103 11.2	27.7	150 23.9	36.2	212 41.9	34.6	57 14.4	17.3
20	265 51.1	118 10.6	26.7	165 24.6	36.1	227 44.2	34.6	72 16.7	17.4
21	280 53.6	133 10.1	25.7	180 25.3	36.0	242 46.6	34.6	87 18.9	17.5
22	295 56.1	148 09.5	24.7	195 25.9	35.9	257 49.0	34.6	102 21.2	17.6
23	310 58.5	163 08.9	23.7	210 26.6	35.8	272 51.3	34.7	117 23.4	17.7
18 00	326 01.0	178 08.4	N14 22.7	225 27.3	N23 35.7	287 53.7	N13 34.7	132 25.7	S 3 17.8
01	341 03.5	193 07.8	21.7	240 28.0	35.6	302 56.1	34.7	147 27.9	17.9
02	356 05.9	208 07.3	20.7	255 28.7	35.6	317 58.4	34.7	162 30.2	18.0
03	11 08.4	223 06.7	19.7	270 29.4	35.5	333 00.8	34.7	177 32.4	18.1
04	26 10.9	238 06.2	18.7	285 30.0	35.4	348 03.1	34.8	192 34.7	18.1
05	41 13.3	253 05.6	17.6	300 30.7	35.3	3 05.5	34.8	207 36.9	18.2
06	56 15.8	268 05.1	N14 16.6	315 31.4	N23 35.2	18 07.9	N13 34.8	222 39.2	S 3 18.3
T 07	71 18.3	283 04.5	15.6	330 32.1	35.1	33 10.2	34.8	237 41.4	18.4
H 08	86 20.7	298 04.0	14.6	345 32.8	35.0	48 12.6	34.9	252 43.7	18.5
U 09	101 23.2	313 03.4	13.6	0 33.5	34.9	63 15.0	34.9	267 45.9	18.6
R 10	116 25.6	328 02.9	12.6	15 34.2	34.8	78 17.3	34.9	282 48.2	18.7
S 11	131 28.1	343 02.3	11.6	30 34.8	34.8	93 19.7	34.9	297 50.4	18.8
D 12	146 30.6	358 01.8	N14 10.5	45 35.5	N23 34.7	108 22.1	N13 34.9	312 52.7	S 3 18.9
A 13	161 33.0	13 01.2	09.5	60 36.2	34.6	123 24.4	35.0	327 54.9	19.0
Y 14	176 35.5	28 00.7	08.5	75 36.9	34.5	138 26.8	35.0	342 57.2	19.1
15	191 38.0	43 00.1	07.5	90 37.6	34.4	153 29.2	35.0	357 59.4	19.2
16	206 40.4	57 59.6	06.5	105 38.3	34.3	168 31.5	35.0	13 01.7	19.3
17	221 42.9	72 59.1	05.5	120 39.0	34.2	183 33.9	35.1	28 03.9	19.4
18	236 45.4	87 58.5	N14 04.4	135 39.6	N23 34.1	198 36.3	N13 35.1	43 06.2	S 3 19.5
19	251 47.8	102 58.0	03.4	150 40.3	34.0	213 38.6	35.1	58 08.4	19.6
20	266 50.3	117 57.4	02.4	165 41.0	33.9	228 41.0	35.1	73 10.7	19.7
21	281 52.8	132 56.9	01.4	180 41.7	33.8	243 43.4	35.1	88 12.9	19.8
22	296 55.2	147 56.3	14 00.4	195 42.4	33.8	258 45.7	35.2	103 15.2	19.9
23	311 57.7	162 55.8	13 59.3	210 43.1	33.7	273 48.1	35.2	118 17.4	20.0
19 00	327 00.1	177 55.2	N13 58.3	225 43.8	N23 33.6	288 50.5	N13 35.2	133 19.7	S 3 20.1
01	342 02.6	192 54.7	57.3	240 44.4	33.5	303 52.8	35.2	148 21.9	20.2
02	357 05.1	207 54.2	56.3	255 45.1	33.4	318 55.2	35.2	163 24.2	20.3
03	12 07.5	222 53.6	55.2	270 45.8	33.3	333 57.6	35.3	178 26.4	20.4
04	27 10.0	237 53.1	54.2	285 46.5	33.2	348 59.9	35.3	193 28.7	20.5
05	42 12.5	252 52.5	53.2	300 47.2	33.1	4 02.3	35.3	208 30.9	20.6
06	57 14.9	267 52.0	N13 52.2	315 47.9	N23 33.0	19 04.7	N13 35.3	223 33.2	S 3 20.7
07	72 17.4	282 51.5	51.1	330 48.6	32.9	34 07.1	35.3	238 35.4	20.8
08	87 19.9	297 50.9	50.1	345 49.3	32.8	49 09.4	35.4	253 37.7	20.9
F 09	102 22.3	312 50.4	49.1	0 49.9	32.7	64 11.8	35.4	268 39.9	21.0
R 10	117 24.8	327 49.8	48.0	15 50.6	32.6	79 14.2	35.4	283 42.2	21.1
I 11	132 27.2	342 49.3	47.0	30 51.3	32.5	94 16.5	35.4	298 44.4	21.2
D 12	147 29.7	357 48.8	N13 46.0	45 52.0	N23 32.4	109 18.9	N13 35.4	313 46.7	S 3 21.3
A 13	162 32.2	12 48.2	45.0	60 52.7	32.3	124 21.3	35.5	328 48.9	21.4
Y 14	177 34.6	27 47.7	43.9	75 53.4	32.2	139 23.7	35.5	343 51.2	21.4
15	192 37.1	42 47.2	42.9	90 54.1	32.1	154 26.0	35.5	358 53.4	21.5
16	207 39.6	57 46.6	41.9	105 54.8	32.0	169 28.4	35.5	13 55.7	21.6
17	222 42.0	72 46.1	40.8	120 55.5	31.9	184 30.8	35.5	28 57.9	21.7
18	237 44.5	87 45.5	N13 39.8	135 56.2	N23 31.8	199 33.2	N13 35.6	44 00.1	S 3 21.8
19	252 47.0	102 45.0	38.8	150 56.8	31.7	214 35.5	35.6	59 02.4	21.9
20	267 49.4	117 44.5	37.7	165 57.5	31.6	229 37.9	35.6	74 04.6	22.0
21	282 51.9	132 43.9	36.7	180 58.2	31.5	244 40.3	35.6	89 06.9	22.1
22	297 54.4	147 43.4	35.6	195 58.9	31.4	259 42.7	35.6	104 09.1	22.2
23	312 56.8	162 42.9	34.6	210 59.6	31.3	274 45.0	35.7	119 11.4	22.3
	h m								
Mer. Pass.	2 15.6	v −0.5	d 1.0	v 0.7	d 0.1	v 2.4	d 0.0	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.2	S40 15.2
Achernar	335 27.4	S57 10.3
Acrux	173 11.3	S63 10.1
Adhara	255 13.8	S28 59.2
Aldebaran	290 50.9	N16 32.0
Alioth	166 22.1	N55 54.0
Alkaid	153 00.1	N49 15.5
Al Na'ir	27 44.8	S46 54.0
Alnilam	275 47.8	S 1 11.6
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.1	N26 40.8
Alpheratz	357 44.6	N29 09.4
Altair	62 09.2	N 8 54.2
Ankaa	353 16.6	S42 14.2
Antares	112 27.7	S26 27.5
Arcturus	145 57.0	N19 07.5
Atria	107 30.5	S69 03.1
Avior	234 19.2	S59 32.8
Bellatrix	278 33.5	N 6 21.6
Betelgeuse	271 02.9	N 7 24.6
Canopus	263 57.1	S52 41.9
Capella	280 36.5	N46 00.4
Deneb	49 31.9	N45 19.6
Denebola	182 35.2	N14 30.5
Diphda	348 56.9	S17 55.1
Dubhe	193 53.8	N61 41.3
Elnath	278 14.4	N28 36.9
Eltanin	90 46.4	N51 29.6
Enif	33 48.1	N 9 55.9
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.8	S57 10.9
Gienah	175 53.9	S17 36.5
Hadar	148 50.0	S60 26.0
Hamal	328 02.1	N23 31.1
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 20.0	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.3	N 4 08.2
Menkent	148 09.3	S36 25.8
Miaplacidus	221 41.0	S69 45.9
Mirfak	308 42.2	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.6	S56 41.7
Pollux	243 29.6	N27 59.8
Procyon	245 01.3	N 5 11.7
Rasalhague	96 07.5	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.4	S 8 11.2
Rigil Kent.	139 53.7	S60 53.2
Sabik	102 13.9	S15 44.3
Schedar	349 41.7	N56 36.0
Shaula	96 23.4	S37 06.7
Sirius	258 35.1	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.9	S43 28.8
Vega	80 39.5	N38 48.0
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	212 07.4	12 08
Mars	259 26.3	8 58
Jupiter	321 52.7	4 48
Saturn	166 24.7	15 08

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
17 00	178 56.5	N13 35.8	327 02.1	15.8	N 4 34.8	11.5	54.3
01	193 56.6	35.0	341 36.9	15.8	4 46.3	11.5	54.3
02	208 56.7	34.2	356 11.7	15.8	4 57.8	11.5	54.3
03	223 56.9	33.4	10 46.5	15.8	5 09.3	11.5	54.3
04	238 57.0	32.6	25 21.3	15.8	5 20.8	11.4	54.3
05	253 57.1	31.8	39 56.1	15.8	5 32.2	11.5	54.3
06	268 57.3	N13 31.0	54 30.9	15.8	N 5 43.7	11.3	54.3
W 07	283 57.4	30.2	69 05.7	15.8	5 55.0	11.4	54.3
E 08	298 57.5	29.4	83 40.5	15.8	6 06.4	11.3	54.2
D 09	313 57.7	28.6	98 15.3	15.8	6 17.7	11.3	54.2
N 10	328 57.8	27.8	112 50.1	15.7	6 29.0	11.3	54.2
E 11	343 57.9	27.0	127 24.8	15.7	6 40.3	11.3	54.2
S 12	358 58.1	N13 26.2	141 59.5	15.8	N 6 51.6	11.2	54.2
D 13	13 58.2	25.4	156 34.3	15.7	7 02.8	11.2	54.2
A 14	28 58.3	24.6	171 09.0	15.7	7 14.0	11.1	54.2
Y 15	43 58.5	23.8	185 43.7	15.7	7 25.1	11.1	54.2
16	58 58.6	23.0	200 18.4	15.6	7 36.2	11.1	54.2
17	73 58.7	22.2	214 53.0	15.7	7 47.3	11.1	54.2
18	88 58.9	N13 21.4	229 27.7	15.6	N 7 58.4	11.0	54.2
19	103 59.0	20.6	244 02.3	15.6	8 09.4	11.0	54.2
20	118 59.1	19.8	258 36.9	15.6	8 20.4	10.9	54.2
21	133 59.3	19.0	273 11.5	15.6	8 31.3	11.0	54.2
22	148 59.4	18.2	287 46.1	15.6	8 42.3	10.8	54.2
23	163 59.6	17.4	302 20.7	15.5	8 53.1	10.9	54.2
18 00	178 59.7	N13 16.6	316 55.2	15.5	N 9 04.0	10.8	54.2
01	193 59.8	15.8	331 29.7	15.5	9 14.8	10.7	54.1
02	209 00.0	15.0	346 04.2	15.5	9 25.5	10.8	54.1
03	224 00.1	14.2	0 38.7	15.4	9 36.3	10.6	54.1
04	239 00.2	13.4	15 13.1	15.4	9 46.9	10.7	54.1
05	254 00.4	12.6	29 47.5	15.4	9 57.6	10.6	54.1
06	269 00.5	N13 11.8	44 21.9	15.4	N10 08.2	10.5	54.1
T 07	284 00.7	11.0	58 56.3	15.3	10 18.7	10.6	54.1
H 08	299 00.8	10.2	73 30.6	15.4	10 29.3	10.4	54.1
U 09	314 00.9	09.4	88 05.0	15.2	10 39.7	10.5	54.1
R 10	329 01.1	08.6	102 39.2	15.3	10 50.2	10.3	54.1
S 11	344 01.2	07.8	117 13.5	15.2	11 00.5	10.4	54.1
D 12	359 01.3	N13 07.0	131 47.7	15.2	N11 10.9	10.3	54.1
A 13	14 01.5	06.2	146 21.9	15.2	11 21.2	10.2	54.1
Y 14	29 01.6	05.4	160 56.1	15.1	11 31.4	10.2	54.1
15	44 01.8	04.5	175 30.2	15.1	11 41.6	10.2	54.1
16	59 01.9	03.7	190 04.3	15.1	11 51.8	10.1	54.1
17	74 02.0	02.9	204 38.4	15.0	12 01.9	10.0	54.1
18	89 02.2	N13 02.1	219 12.4	15.1	N12 11.9	10.0	54.1
19	104 02.3	01.3	233 46.5	14.9	12 21.9	10.0	54.1
20	119 02.5	13 00.5	248 20.4	15.0	12 31.9	9.9	54.1
21	134 02.6	12 59.7	262 54.4	14.9	12 41.8	9.9	54.1
22	149 02.7	58.9	277 28.3	14.8	12 51.7	9.8	54.1
23	164 02.9	58.1	292 02.1	14.8	13 01.5	9.7	54.1
19 00	179 03.0	N12 57.3	306 35.9	14.8	N13 11.2	9.7	54.1
01	194 03.2	56.5	321 09.7	14.8	13 20.9	9.7	54.1
02	209 03.3	55.6	335 43.5	14.7	13 30.6	9.5	54.1
03	224 03.5	54.8	350 17.2	14.6	13 40.1	9.6	54.1
04	239 03.6	54.0	4 50.8	14.7	13 49.7	9.4	54.1
05	254 03.7	53.2	19 24.5	14.6	13 59.1	9.5	54.1
06	269 03.9	N12 52.4	33 58.1	14.5	N14 08.6	9.3	54.1
07	284 04.0	51.6	48 31.6	14.5	14 17.9	9.3	54.1
08	299 04.2	50.8	63 05.1	14.5	14 27.2	9.3	54.2
F 09	314 04.3	50.0	77 38.6	14.4	14 36.5	9.2	54.2
R 10	329 04.5	49.1	92 12.0	14.4	14 45.7	9.1	54.2
I 11	344 04.6	48.3	106 45.4	14.3	14 54.8	9.1	54.2
D 12	359 04.7	N12 47.5	121 18.7	14.3	N15 03.9	9.0	54.2
A 13	14 04.9	46.7	135 52.0	14.2	15 12.9	8.9	54.2
Y 14	29 05.0	45.9	150 25.2	14.2	15 21.8	8.9	54.2
15	44 05.2	45.1	164 58.4	14.2	15 30.7	8.8	54.2
16	59 05.3	44.3	179 31.6	14.0	15 39.5	8.8	54.2
17	74 05.5	43.4	194 04.6	14.1	15 48.3	8.7	54.2
18	89 05.6	N12 42.6	208 37.7	14.0	N15 57.0	8.6	54.2
19	104 05.8	41.8	223 10.7	14.0	16 05.6	8.6	54.2
20	119 05.9	41.0	237 43.7	13.9	16 14.2	8.4	54.2
21	134 06.0	40.2	252 16.6	13.8	16 22.6	8.5	54.2
22	149 06.2	39.3	266 49.4	13.8	16 31.1	8.3	54.2
23	164 06.3	38.5	281 22.2	13.8	N16 39.4	8.3	54.2
	SD 15.8	d 0.8	SD	14.8		14.7	14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 17	Moonrise 18	Moonrise 19	Moonrise 20
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	02 42	19 00	18 37	18 02	
N 70	////	01 08	03 10	19 12	18 58	18 40	18 06
68	////	02 02	03 30	19 22	19 15	19 06	18 56
66	////	02 34	03 46	19 30	19 28	19 27	19 27
64	01 00	02 57	04 00	19 36	19 39	19 43	19 51
62	01 48	03 15	04 11	19 42	19 49	19 57	20 10
60	02 18	03 30	04 20	19 47	19 57	20 09	20 25
N 58	02 39	03 43	04 29	19 52	20 04	20 19	20 39
56	02 56	03 53	04 36	19 56	20 10	20 28	20 50
54	03 10	04 02	04 42	20 00	20 16	20 36	21 00
52	03 22	04 11	04 48	20 03	20 21	20 43	21 09
50	03 33	04 18	04 53	20 06	20 26	20 49	21 17
45	03 54	04 33	05 05	20 13	20 36	21 03	21 34
N 40	04 10	04 45	05 14	20 18	20 45	21 15	21 48
35	04 23	04 55	05 22	20 23	20 52	21 24	22 00
30	04 34	05 04	05 29	20 27	20 59	21 33	22 11
20	04 51	05 18	05 41	20 35	21 10	21 48	22 29
N 10	05 04	05 29	05 51	20 41	21 20	22 01	22 45
0	05 15	05 39	06 01	20 47	21 30	22 13	22 59
S 10	05 24	05 48	06 10	20 53	21 39	22 26	23 14
20	05 31	05 57	06 20	21 00	21 49	22 39	23 30
30	05 38	06 07	06 31	21 08	22 01	22 55	23 49
35	05 42	06 12	06 38	21 12	22 08	23 03	24 00
40	05 45	06 17	06 45	21 17	22 15	23 14	24 12
45	05 48	06 23	06 53	21 23	22 24	23 26	24 27
S 50	05 52	06 30	07 03	21 30	22 35	23 40	24 45
52	05 53	06 33	07 08	21 34	22 41	23 47	24 53
54	05 55	06 36	07 13	21 37	22 46	23 55	25 03
56	05 56	06 40	07 19	21 41	22 52	24 04	00 04
58	05 58	06 44	07 25	21 46	22 59	24 13	00 13
S 60	05 59	06 48	07 32	21 51	23 08	24 25	00 25

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 17	Moonset 18	Moonset 19	Moonset 20
°	h m	h m	h m	h m	h m	h m	h m
N 72	21 21	////	////	09 48	11 40	13 46	
N 70	20 55	22 48	////	09 39	11 20	13 09	15 17
68	20 35	22 00	////	09 31	11 05	12 43	14 28
66	20 19	21 30	////	09 25	10 53	12 24	13 57
64	20 06	21 07	22 58	09 19	10 43	12 08	13 34
62	19 55	20 50	22 14	09 15	10 35	11 55	13 16
60	19 46	20 35	21 47	09 11	10 27	11 44	13 01
N 58	19 38	20 23	21 26	09 07	10 21	11 35	12 48
56	19 31	20 13	21 09	09 04	10 15	11 27	12 37
54	19 24	20 04	20 55	09 01	10 10	11 19	12 28
52	19 19	19 56	20 44	08 59	10 06	11 13	12 19
50	19 13	19 49	20 33	08 56	10 02	11 07	12 11
45	19 02	19 34	20 13	08 51	09 53	10 54	11 55
N 40	18 53	19 22	19 57	08 47	09 45	10 43	11 42
35	18 45	19 12	19 44	08 44	09 39	10 35	11 31
30	18 39	19 04	19 33	08 40	09 33	10 27	11 21
20	18 27	18 50	19 16	08 35	09 24	10 13	11 04
N 10	18 17	18 38	19 04	08 30	09 15	10 02	10 49
0	18 07	18 28	18 53	08 26	09 08	09 51	10 35
S 10	17 58	18 19	18 44	08 21	09 00	09 40	10 22
20	17 48	18 11	18 37	08 16	08 51	09 28	10 07
30	17 37	18 02	18 30	08 11	08 42	09 15	09 50
35	17 31	17 57	18 26	08 08	08 36	09 07	09 41
40	17 24	17 51	18 23	08 04	08 30	08 58	09 30
45	17 15	17 46	18 20	08 00	08 23	08 48	09 17
S 50	17 05	17 39	18 17	07 55	08 15	08 36	09 01
52	17 01	17 36	18 15	07 53	08 11	08 30	08 54
54	16 56	17 33	18 14	07 51	08 06	08 24	08 46
56	16 50	17 29	18 13	07 48	08 02	08 17	08 37
58	16 44	17 25	18 11	07 45	07 56	08 10	08 26
S 60	16 37	17 21	18 10	07 42	07 50	08 01	08 15

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
17	04 14	04 08	12 04	02 16	14 36	18	87
18	04 02	03 55	12 04	02 57	15 19	19	80
19	03 48	03 41	12 04	03 40	16 02	20	72

UT	ARIES	VENUS −4.0		MARS +1.4		JUPITER −2.6		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
20 00	327 59.3	177 42.3	N13 33.6	226 00.3	N23 31.2	289 47.4	N13 35.7	134 13.6	S 3 22.4
01	343 01.7	192 41.8	32.5	241 01.0	31.1	304 49.8	35.7	149 15.9	22.5
02	358 04.2	207 41.3	31.5	256 01.7	31.0	319 52.2	35.7	164 18.1	22.6
03	13 06.7	222 40.8	30.4	271 02.4	30.9	334 54.6	35.7	179 20.4	22.7
04	28 09.1	237 40.2	29.4	286 03.1	30.8	349 56.9	35.7	194 22.6	22.8
05	43 11.6	252 39.7	28.4	301 03.8	30.7	4 59.3	35.8	209 24.9	22.9
06	58 14.1	267 39.2	N13 27.3	316 04.5	N23 30.6	20 01.7	N13 35.8	224 27.1	S 3 23.0
07	73 16.5	282 38.6	26.3	331 05.1	30.5	35 04.1	35.8	239 29.4	23.1
S 08	88 19.0	297 38.1	25.2	346 05.8	30.4	50 06.5	35.8	254 31.6	23.2
A 09	103 21.5	312 37.6	24.2	1 06.5	30.3	65 08.8	35.8	269 33.8	23.3
T 10	118 23.9	327 37.0	23.1	16 07.2	30.2	80 11.2	35.9	284 36.1	23.4
U 11	133 26.4	342 36.5	22.1	31 07.9	30.1	95 13.6	35.9	299 38.3	23.5
R 12	148 28.8	357 36.0	N13 21.0	46 08.6	N23 30.0	110 16.0	N13 35.9	314 40.6	S 3 23.6
D 13	163 31.3	12 35.5	20.0	61 09.3	29.9	125 18.4	35.9	329 42.8	23.7
A 14	178 33.8	27 34.9	19.0	76 10.0	29.8	140 20.7	35.9	344 45.1	23.8
Y 15	193 36.2	42 34.4	17.9	91 10.7	29.7	155 23.1	35.9	359 47.3	23.9
16	208 38.7	57 33.9	16.9	106 11.4	29.5	170 25.5	36.0	14 49.6	24.0
17	223 41.2	72 33.4	15.8	121 12.1	29.4	185 27.9	36.0	29 51.8	24.1
18	238 43.6	87 32.8	N13 14.8	136 12.8	N23 29.3	200 30.3	N13 36.0	44 54.0	S 3 24.2
19	253 46.1	102 32.3	13.7	151 13.5	29.2	215 32.6	36.0	59 56.3	24.3
20	268 48.6	117 31.8	12.7	166 14.2	29.1	230 35.0	36.0	74 58.5	24.4
21	283 51.0	132 31.3	11.6	181 14.9	29.0	245 37.4	36.0	90 00.8	24.5
22	298 53.5	147 30.7	10.5	196 15.6	28.9	260 39.8	36.1	105 03.0	24.6
23	313 56.0	162 30.2	09.5	211 16.2	28.8	275 42.2	36.1	120 05.3	24.7
21 00	328 58.4	177 29.7	N13 08.4	226 16.9	N23 28.7	290 44.6	N13 36.1	135 07.5	S 3 24.8
01	344 00.9	192 29.2	07.4	241 17.6	28.6	305 47.0	36.1	150 09.8	24.9
02	359 03.3	207 28.6	06.3	256 18.3	28.5	320 49.3	36.1	165 12.0	25.0
03	14 05.8	222 28.1	05.3	271 19.0	28.4	335 51.7	36.1	180 14.2	25.1
04	29 08.3	237 27.6	04.2	286 19.7	28.2	350 54.1	36.1	195 16.5	25.2
05	44 10.7	252 27.1	03.2	301 20.4	28.1	5 56.5	36.2	210 18.7	25.3
06	59 13.2	267 26.6	N13 02.1	316 21.1	N23 28.0	20 58.9	N13 36.2	225 21.0	S 3 25.4
07	74 15.7	282 26.0	01.0	331 21.8	27.9	36 01.3	36.2	240 23.2	25.5
08	89 18.1	297 25.5	13 00.0	346 22.5	27.8	51 03.7	36.2	255 25.5	25.6
S 09	104 20.6	312 25.0	12 58.9	1 23.2	27.7	66 06.0	36.2	270 27.7	25.7
U 10	119 23.1	327 24.5	57.9	16 23.9	27.6	81 08.4	36.2	285 30.0	25.8
N 11	134 25.5	342 24.0	56.8	31 24.6	27.5	96 10.8	36.2	300 32.2	25.9
D 12	149 28.0	357 23.5	N12 55.7	46 25.3	N23 27.3	111 13.2	N13 36.3	315 34.4	S 3 26.0
A 13	164 30.5	12 22.9	54.7	61 26.0	27.2	126 15.6	36.3	330 36.7	26.1
Y 14	179 32.9	27 22.4	53.6	76 26.7	27.1	141 18.0	36.3	345 38.9	26.2
15	194 35.4	42 21.9	52.6	91 27.4	27.0	156 20.4	36.3	0 41.2	26.3
16	209 37.8	57 21.4	51.5	106 28.1	26.9	171 22.8	36.3	15 43.4	26.4
17	224 40.3	72 20.9	50.4	121 28.8	26.8	186 25.2	36.3	30 45.7	26.5
18	239 42.8	87 20.4	N12 49.4	136 29.5	N23 26.7	201 27.6	N13 36.3	45 47.9	S 3 26.6
19	254 45.2	102 19.8	48.3	151 30.2	26.5	216 29.9	36.4	60 50.1	26.7
20	269 47.7	117 19.3	47.2	166 30.9	26.4	231 32.3	36.4	75 52.4	26.8
21	284 50.2	132 18.8	46.2	181 31.6	26.3	246 34.7	36.4	90 54.6	26.9
22	299 52.6	147 18.3	45.1	196 32.3	26.2	261 37.1	36.4	105 56.9	27.0
23	314 55.1	162 17.8	44.0	211 33.0	26.1	276 39.5	36.4	120 59.1	27.1
22 00	329 57.6	177 17.3	N12 43.0	226 33.7	N23 26.0	291 41.9	N13 36.4	136 01.3	S 3 27.2
01	345 00.0	192 16.8	41.9	241 34.4	25.9	306 44.3	36.4	151 03.6	27.3
02	0 02.5	207 16.3	40.8	256 35.1	25.7	321 46.7	36.5	166 05.8	27.4
03	15 05.0	222 15.7	39.7	271 35.8	25.6	336 49.1	36.5	181 08.1	27.5
04	30 07.4	237 15.2	38.7	286 36.5	25.5	351 51.5	36.5	196 10.3	27.6
05	45 09.9	252 14.7	37.6	301 37.2	25.4	6 53.9	36.5	211 12.6	27.7
06	60 12.3	267 14.2	N12 36.5	316 37.9	N23 25.3	21 56.3	N13 36.5	226 14.8	S 3 27.8
07	75 14.8	282 13.7	35.5	331 38.6	25.1	36 58.7	36.5	241 17.0	27.9
08	90 17.3	297 13.2	34.4	346 39.3	25.0	52 01.1	36.5	256 19.3	28.0
M 09	105 19.7	312 12.7	33.3	1 40.0	24.9	67 03.5	36.5	271 21.5	28.1
O 10	120 22.2	327 12.2	32.2	16 40.7	24.8	82 05.9	36.6	286 23.8	28.2
N 11	135 24.7	342 11.7	31.2	31 41.4	24.7	97 08.3	36.6	301 26.0	28.3
D 12	150 27.1	357 11.2	N12 30.1	46 42.1	N23 24.5	112 10.6	N13 36.6	316 28.2	S 3 28.4
A 13	165 29.6	12 10.7	29.0	61 42.8	24.4	127 13.0	36.6	331 30.5	28.5
Y 14	180 32.1	27 10.1	27.9	76 43.5	24.3	142 15.4	36.6	346 32.7	28.6
15	195 34.5	42 09.6	26.9	91 44.2	24.2	157 17.8	36.6	1 35.0	28.7
16	210 37.0	57 09.1	25.8	106 44.9	24.1	172 20.2	36.6	16 37.2	28.8
17	225 39.4	72 08.6	24.7	121 45.6	23.9	187 22.6	36.6	31 39.4	28.9
18	240 41.9	87 08.1	N12 23.6	136 46.3	N23 23.8	202 25.0	N13 36.7	46 41.7	S 3 29.0
19	255 44.4	102 07.6	22.5	151 47.0	23.7	217 27.4	36.7	61 43.9	29.1
20	270 46.8	117 07.1	21.5	166 47.7	23.6	232 29.8	36.7	76 46.2	29.2
21	285 49.3	132 06.6	20.4	181 48.4	23.4	247 32.2	36.7	91 48.4	29.3
22	300 51.8	147 06.1	19.3	196 49.1	23.3	262 34.6	36.7	106 50.7	29.4
23	315 54.2	162 05.6	18.2	211 49.8	23.2	277 37.0	36.7	121 52.9	29.5
	h m								
Mer. Pass.	2 03.8	v −0.5	d 1.1	v 0.7	d 0.1	v 2.4	d 0.0	v 2.2	d 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.2	S40 15.2
Achernar	335 27.3	S57 10.3
Acrux	173 11.3	S63 10.1
Adhara	255 13.8	S28 59.2
Aldebaran	290 50.9	N16 32.0
Alioth	166 22.1	N55 54.0
Alkaid	153 00.1	N49 15.5
Al Na'ir	27 44.8	S46 54.0
Alnilam	275 47.8	S 1 11.6
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.1	N26 40.8
Alpheratz	357 44.5	N29 09.4
Altair	62 09.2	N 8 54.2
Ankaa	353 16.6	S42 14.2
Antares	112 27.8	S26 27.5
Arcturus	145 57.0	N19 07.5
Atria	107 30.6	S69 03.1
Avior	234 19.2	S59 32.8
Bellatrix	278 33.5	N 6 21.6
Betelgeuse	271 02.9	N 7 24.6
Canopus	263 57.1	S52 41.9
Capella	280 36.5	N46 00.4
Deneb	49 31.9	N45 19.6
Denebola	182 35.2	N14 30.5
Diphda	348 56.9	S17 55.1
Dubhe	193 53.8	N61 41.3
Elnath	278 14.4	N28 36.9
Eltanin	90 46.4	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.8	S57 10.9
Gienah	175 53.9	S17 36.5
Hadar	148 50.0	S60 26.0
Hamal	328 02.1	N23 31.1
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 20.1	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.3	N 4 08.2
Menkent	148 09.3	S36 25.8
Miaplacidus	221 41.0	S69 45.9
Mirfak	308 42.2	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.6	S56 41.7
Pollux	243 29.6	N27 59.8
Procyon	245 01.3	N 5 11.7
Rasalhague	96 07.5	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.4	S 8 11.2
Rigil Kent.	139 53.7	S60 53.2
Sabik	102 13.9	S15 44.3
Schedar	349 41.6	N56 36.1
Shaula	96 23.5	S37 06.7
Sirius	258 35.1	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.9	S43 28.8
Vega	80 39.5	N38 48.0
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	208 31.3	12 10
Mars	257 18.5	8 54
Jupiter	321 46.2	4 36
Saturn	166 09.1	14 57

UT	SUN			MOON					
	GHA		Dec	GHA	v	Dec	d	HP	
d h	° ′		° ′	° ′	′	° ′	′	′	
20 00	179 06.5		N12 37.7	295 55.0	13.7	N16 47.7	8.2	54.3	
01	194 06.6		36.9	310 27.7	13.6	16 55.9	8.2	54.3	
02	209 06.8		36.1	325 00.3	13.6	17 04.1	8.1	54.3	
03	224 06.9	. .	35.3	339 32.9	13.6	17 12.2	8.0	54.3	
04	239 07.1		34.4	354 05.5	13.5	17 20.2	7.9	54.3	
05	254 07.2		33.6	8 38.0	13.4	17 28.1	7.9	54.3	
06	269 07.4		N12 32.8	23 10.4	13.4	N17 36.0	7.8	54.3	
07	284 07.5		32.0	37 42.8	13.4	17 43.8	7.7	54.3	
S 08	299 07.7		31.1	52 15.2	13.3	17 51.5	7.6	54.3	
A 09	314 07.8	. .	30.3	66 47.5	13.2	17 59.1	7.6	54.3	
T 10	329 08.0		29.5	81 19.7	13.2	18 06.7	7.5	54.4	
U 11	344 08.1		28.7	95 51.9	13.1	18 14.2	7.4	54.4	
R 12	359 08.3		N12 27.9	110 24.0	13.0	N18 21.6	7.3	54.4	
D 13	14 08.4		27.0	124 56.0	13.1	18 28.9	7.3	54.4	
A 14	29 08.6		26.2	139 28.1	12.9	18 36.2	7.2	54.4	
Y 15	44 08.7	. .	25.4	154 00.0	12.9	18 43.4	7.1	54.4	
16	59 08.9		24.6	168 31.9	12.8	18 50.5	7.0	54.4	
17	74 09.0		23.7	183 03.7	12.8	18 57.5	7.0	54.4	
18	89 09.2		N12 22.9	197 35.5	12.8	N19 04.5	6.8	54.5	
19	104 09.3		22.1	212 07.3	12.6	19 11.3	6.8	54.5	
20	119 09.5		21.3	226 38.9	12.6	19 18.1	6.7	54.5	
21	134 09.6	. .	20.4	241 10.5	12.6	19 24.8	6.6	54.5	
22	149 09.8		19.6	255 42.1	12.5	19 31.4	6.5	54.5	
23	164 09.9		18.8	270 13.6	12.4	19 37.9	6.5	54.5	
21 00	179 10.1		N12 18.0	284 45.0	12.4	N19 44.4	6.3	54.5	
01	194 10.2		17.1	299 16.4	12.3	19 50.7	6.3	54.6	
02	209 10.4		16.3	313 47.7	12.3	19 57.0	6.2	54.6	
03	224 10.5	. .	15.5	328 19.0	12.2	20 03.2	6.1	54.6	
04	239 10.7		14.6	342 50.2	12.1	20 09.3	6.0	54.6	
05	254 10.8		13.8	357 21.3	12.1	20 15.3	5.9	54.6	
06	269 11.0		N12 13.0	11 52.4	12.1	N20 21.2	5.8	54.6	
07	284 11.1		12.2	26 23.5	11.9	20 27.0	5.7	54.7	
08	299 11.3		11.3	40 54.4	11.9	20 32.7	5.7	54.7	
S 09	314 11.4	. .	10.5	55 25.3	11.9	20 38.4	5.5	54.7	
U 10	329 11.6		09.7	69 56.2	11.8	20 43.9	5.5	54.7	
N 11	344 11.7		08.8	84 27.0	11.7	20 49.4	5.3	54.7	
D 12	359 11.9		N12 08.0	98 57.7	11.7	N20 54.7	5.3	54.7	
A 13	14 12.0		07.2	113 28.4	11.6	21 00.0	5.2	54.8	
Y 14	29 12.2		06.3	127 59.0	11.5	21 05.2	5.1	54.8	
15	44 12.4	. .	05.5	142 29.5	11.5	21 10.3	4.9	54.8	
16	59 12.5		04.7	157 00.0	11.5	21 15.2	4.9	54.8	
17	74 12.7		03.8	171 30.5	11.4	21 20.1	4.8	54.8	
18	89 12.8		N12 03.0	186 00.9	11.3	N21 24.9	4.7	54.9	
19	104 13.0		02.2	200 31.2	11.2	21 29.6	4.6	54.9	
20	119 13.1		01.3	215 01.4	11.2	21 34.2	4.5	54.9	
21	134 13.3	12	00.5	229 31.6	11.2	21 38.7	4.4	54.9	
22	149 13.4	11	59.7	244 01.8	11.1	21 43.1	4.3	55.0	
23	164 13.6		58.8	258 31.9	11.0	21 47.4	4.2	55.0	
22 00	179 13.8		N11 58.0	273 01.9	11.0	N21 51.6	4.0	55.0	
01	194 13.9		57.2	287 31.9	10.9	21 55.6	4.0	55.0	
02	209 14.1		56.3	302 01.8	10.8	21 59.6	3.9	55.0	
03	224 14.2	. .	55.5	316 31.6	10.8	22 03.5	3.8	55.1	
04	239 14.4		54.7	331 01.4	10.8	22 07.3	3.6	55.1	
05	254 14.5		53.8	345 31.2	10.7	22 10.9	3.6	55.1	
06	269 14.7		N11 53.0	0 00.9	10.6	N22 14.5	3.5	55.1	
07	284 14.9		52.1	14 30.5	10.6	22 18.0	3.3	55.2	
08	299 15.0		51.3	29 00.1	10.5	22 21.3	3.2	55.2	
M 09	314 15.2	. .	50.5	43 29.6	10.4	22 24.5	3.2	55.2	
O 10	329 15.3		49.6	57 59.0	10.4	22 27.7	3.0	55.2	
N 11	344 15.5		48.8	72 28.4	10.4	22 30.7	2.9	55.3	
D 12	359 15.6		N11 47.9	86 57.8	10.3	N22 33.6	2.8	55.3	
A 13	14 15.8		47.1	101 27.1	10.2	22 36.4	2.7	55.3	
Y 14	29 16.0		46.3	115 56.3	10.2	22 39.1	2.6	55.3	
15	44 16.1	. .	45.4	130 25.5	10.2	22 41.7	2.4	55.4	
16	59 16.3		44.6	144 54.7	10.0	22 44.1	2.4	55.4	
17	74 16.4		43.7	159 23.7	10.1	22 46.5	2.2	55.4	
18	89 16.6		N11 42.9	173 52.8	10.0	N22 48.7	2.2	55.4	
19	104 16.8		42.1	188 21.8	9.9	22 50.9	2.0	55.5	
20	119 16.9		41.2	202 50.7	9.9	22 52.9	1.9	55.5	
21	134 17.1	. .	40.4	217 19.6	9.8	22 54.8	1.8	55.5	
22	149 17.2		39.5	231 48.4	9.8	22 56.6	1.6	55.6	
23	164 17.4		38.7	246 17.2	9.7	N22 58.2	1.6	55.6	
	SD 15.8		d 0.8	SD 14.8		14.9		15.1	

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		20	21	22	23
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	////	03 00				
N 70	////	01 41	03 24	18 06			
68	////	02 21	03 42	18 56	18 35		
66	////	02 49	03 57	19 27	19 32	19 46	20 32
64	01 29	03 09	04 09	19 51	20 05	20 32	21 21
62	02 05	03 25	04 19	20 10	20 30	21 02	21 52
60	02 30	03 39	04 28	20 25	20 49	21 25	22 16
N 58	02 49	03 50	04 35	20 39	21 05	21 43	22 34
56	03 05	04 00	04 42	20 50	21 19	21 58	22 50
54	03 18	04 08	04 48	21 00	21 31	22 12	23 04
52	03 29	04 16	04 53	21 09	21 42	22 23	23 15
50	03 39	04 23	04 58	21 17	21 51	22 33	23 26
45	03 59	04 37	05 08	21 34	22 11	22 55	23 48
N 40	04 14	04 48	05 17	21 48	22 27	23 13	24 05
35	04 26	04 58	05 24	22 00	22 41	23 27	24 20
30	04 36	05 06	05 31	22 11	22 53	23 40	24 33
20	04 52	05 19	05 42	22 29	23 13	24 02	00 02
N 10	05 04	05 30	05 51	22 45	23 31	24 21	00 21
0	05 14	05 39	06 00	22 59	23 48	24 39	00 39
S 10	05 22	05 47	06 09	23 14	24 05	00 05	00 57
20	05 29	05 55	06 18	23 30	24 23	00 23	01 16
30	05 36	06 04	06 28	23 49	24 44	00 44	01 38
35	05 38	06 08	06 34	24 00	00 00	00 56	01 51
40	05 41	06 13	06 41	24 12	00 12	01 10	02 06
45	05 44	06 18	06 48	24 27	00 27	01 27	02 23
S 50	05 47	06 24	06 58	24 45	00 45	01 47	02 45
52	05 48	06 27	07 02	24 53	00 53	01 57	02 56
54	05 49	06 30	07 06	25 03	01 03	02 08	03 08
56	05 50	06 33	07 12	00 04	01 14	02 21	03 22
58	05 51	06 36	07 17	00 13	01 26	02 36	03 38
S 60	05 52	06 40	07 24	00 25	01 41	02 53	03 57

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	20	21	22	23
°	h m	h m	h m	h m	h m	h m	h m
N 72	21 02	23 49	////				
N 70	20 39	22 18	////	15 17			
68	20 21	21 40	////	14 28	16 28		
66	20 07	21 14	23 51	13 57	15 32	17 01	18 05
64	19 55	20 54	22 31	13 34	14 59	16 16	17 16
62	19 46	20 39	21 57	13 16	14 34	15 46	16 44
60	19 37	20 26	21 33	13 01	14 15	15 24	16 21
N 58	19 30	20 15	21 15	12 48	13 59	15 05	16 02
56	19 23	20 05	20 59	12 37	13 46	14 50	15 46
54	19 17	19 57	20 47	12 28	13 34	14 37	15 33
52	19 12	19 49	20 36	12 19	13 24	14 26	15 21
50	19 08	19 43	20 26	12 11	13 15	14 15	15 11
45	18 57	19 29	20 07	11 55	12 56	13 54	14 49
N 40	18 49	19 17	19 52	11 42	12 40	13 37	14 31
35	18 42	19 08	19 40	11 31	12 27	13 22	14 16
30	18 35	19 00	19 30	11 21	12 15	13 10	14 03
20	18 25	18 47	19 14	11 04	11 56	12 48	13 41
N 10	18 15	18 37	19 02	10 49	11 38	12 30	13 22
0	18 07	18 28	18 52	10 35	11 23	12 12	13 04
S 10	17 58	18 19	18 44	10 22	11 07	11 55	12 46
20	17 49	18 11	18 37	10 07	10 50	11 36	12 27
30	17 39	18 03	18 31	09 50	10 30	11 15	12 05
35	17 33	17 59	18 28	09 41	10 19	11 02	11 52
40	17 26	17 54	18 26	09 30	10 06	10 48	11 37
45	17 19	17 49	18 23	09 17	09 50	10 31	11 19
S 50	17 10	17 43	18 21	09 01	09 32	10 09	10 57
52	17 05	17 40	18 20	08 54	09 23	09 59	10 46
54	17 01	17 37	18 19	08 46	09 13	09 48	10 34
56	16 56	17 34	18 18	08 37	09 02	09 35	10 20
58	16 50	17 31	18 17	08 26	08 49	09 20	10 04
S 60	16 44	17 27	18 16	08 15	08 34	09 02	09 45

Day	SUN			MOON				
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
20	03 34	03 27	12 03	04 24	16 47	21	64
21	03 20	03 13	12 03	05 11	17 35	22	54
22	03 05	02 58	12 03	06 00	18 25	23	44

UT	ARIES	VENUS −4.0		MARS +1.4		JUPITER −2.6		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
23 00	330 56.7	177 05.1	N12 17.1	226 50.5	N23 23.1	292 39.4	N13 36.7	136 55.1	S 3 29.6
01	345 59.2	192 04.6	16.0	241 51.2	23.0	307 41.8	36.7	151 57.4	29.7
02	1 01.6	207 04.1	15.0	256 51.9	22.8	322 44.2	36.7	166 59.6	29.8
03	16 04.1	222 03.6	. . 13.9	271 52.6	. . 22.7	337 46.6	. . 36.7	182 01.8	. . 29.9
04	31 06.6	237 03.1	12.8	286 53.4	22.6	352 49.0	36.8	197 04.1	30.0
05	46 09.0	252 02.6	11.7	301 54.1	22.5	7 51.4	36.8	212 06.3	30.1
06	61 11.5	267 02.1	N12 10.6	316 54.8	N23 22.3	22 53.8	N13 36.8	227 08.6	S 3 30.2
07	76 13.9	282 01.6	09.5	331 55.5	22.2	37 56.3	36.8	242 10.8	30.3
08	91 16.4	297 01.1	08.4	346 56.2	22.1	52 58.7	36.8	257 13.0	30.4
T 09	106 18.9	312 00.6	. . 07.4	1 56.9	. . 21.9	68 01.1	. . 36.8	272 15.3	. . 30.5
U 10	121 21.3	327 00.1	06.3	16 57.6	21.8	83 03.5	36.8	287 17.5	30.6
E 11	136 23.8	341 59.6	05.2	31 58.3	21.7	98 05.9	36.8	302 19.8	30.7
S 12	151 26.3	356 59.1	N12 04.1	46 59.0	N23 21.6	113 08.3	N13 36.8	317 22.0	S 3 30.8
D 13	166 28.7	11 58.6	03.0	61 59.7	21.4	128 10.7	36.8	332 24.2	30.9
A 14	181 31.2	26 58.1	01.9	77 00.4	21.3	143 13.1	36.9	347 26.5	31.0
Y 15	196 33.7	41 57.6	12 00.8	92 01.1	. . 21.2	158 15.5	. . 36.9	2 28.7	. . 31.1
16	211 36.1	56 57.1	11 59.7	107 01.8	21.1	173 17.9	36.9	17 31.0	31.2
17	226 38.6	71 56.6	58.6	122 02.5	20.9	188 20.3	36.9	32 33.2	31.3
18	241 41.1	86 56.1	N11 57.5	137 03.2	N23 20.8	203 22.7	N13 36.9	47 35.4	S 3 31.4
19	256 43.5	101 55.6	56.4	152 04.0	20.7	218 25.1	36.9	62 37.7	31.5
20	271 46.0	116 55.1	55.3	167 04.7	20.5	233 27.5	36.9	77 39.9	31.6
21	286 48.4	131 54.6	. . 54.3	182 05.4	. . 20.4	248 29.9	. . 36.9	92 42.1	. . 31.7
22	301 50.9	146 54.1	53.2	197 06.1	20.3	263 32.3	36.9	107 44.4	31.8
23	316 53.4	161 53.6	52.1	212 06.8	20.1	278 34.7	36.9	122 46.6	31.9
24 00	331 55.8	176 53.1	N11 51.0	227 07.5	N23 20.0	293 37.2	N13 36.9	137 48.9	S 3 32.0
01	346 58.3	191 52.7	49.9	242 08.2	19.9	308 39.6	37.0	152 51.1	32.1
02	2 00.8	206 52.2	48.8	257 08.9	19.7	323 42.0	37.0	167 53.3	32.2
03	17 03.2	221 51.7	. . 47.7	272 09.6	. . 19.6	338 44.4	. . 37.0	182 55.6	. . 32.3
04	32 05.7	236 51.2	46.6	287 10.3	19.5	353 46.8	37.0	197 57.8	32.4
05	47 08.2	251 50.7	45.5	302 11.0	19.4	8 49.2	37.0	213 00.0	32.5
06	62 10.6	266 50.2	N11 44.4	317 11.7	N23 19.2	23 51.6	N13 37.0	228 02.3	S 3 32.6
W 07	77 13.1	281 49.7	43.3	332 12.5	19.1	38 54.0	37.0	243 04.5	32.7
E 08	92 15.6	296 49.2	42.2	347 13.2	19.0	53 56.4	37.0	258 06.8	32.8
D 09	107 18.0	311 48.7	. . 41.1	2 13.9	. . 18.8	68 58.9	. . 37.0	273 09.0	. . 32.9
N 10	122 20.5	326 48.2	40.0	17 14.6	18.7	84 01.3	37.0	288 11.2	33.0
E 11	137 22.9	341 47.7	38.9	32 15.3	18.5	99 03.7	37.0	303 13.5	33.1
S 12	152 25.4	356 47.3	N11 37.8	47 16.0	N23 18.4	114 06.1	N13 37.0	318 15.7	S 3 33.2
D 13	167 27.9	11 46.8	36.7	62 16.7	18.3	129 08.5	37.0	333 17.9	33.3
A 14	182 30.3	26 46.3	35.6	77 17.4	18.1	144 10.9	37.0	348 20.2	33.4
Y 15	197 32.8	41 45.8	. . 34.4	92 18.1	. . 18.0	159 13.3	. . 37.1	3 22.4	. . 33.5
16	212 35.3	56 45.3	33.3	107 18.9	17.9	174 15.7	37.1	18 24.6	33.6
17	227 37.7	71 44.8	32.2	122 19.6	17.7	189 18.2	37.1	33 26.9	33.7
18	242 40.2	86 44.3	N11 31.1	137 20.3	N23 17.6	204 20.6	N13 37.1	48 29.1	S 3 33.8
19	257 42.7	101 43.8	30.0	152 21.0	17.5	219 23.0	37.1	63 31.4	33.9
20	272 45.1	116 43.4	28.9	167 21.7	17.3	234 25.4	37.1	78 33.6	34.0
21	287 47.6	131 42.9	. . 27.8	182 22.4	. . 17.2	249 27.8	. . 37.1	93 35.8	. . 34.1
22	302 50.0	146 42.4	26.7	197 23.1	17.0	264 30.2	37.1	108 38.1	34.2
23	317 52.5	161 41.9	25.6	212 23.8	16.9	279 32.7	37.1	123 40.3	34.3
25 00	332 55.0	176 41.4	N11 24.5	227 24.6	N23 16.8	294 35.1	N13 37.1	138 42.5	S 3 34.4
01	347 57.4	191 40.9	23.4	242 25.3	16.6	309 37.5	37.1	153 44.8	34.5
02	2 59.9	206 40.4	22.3	257 26.0	16.5	324 39.9	37.1	168 47.0	34.6
03	18 02.4	221 40.0	. . 21.1	272 26.7	. . 16.4	339 42.3	. . 37.1	183 49.2	. . 34.7
04	33 04.8	236 39.5	20.0	287 27.4	16.2	354 44.7	37.1	198 51.5	34.8
05	48 07.3	251 39.0	18.9	302 28.1	16.1	9 47.2	37.1	213 53.7	34.9
06	63 09.8	266 38.5	N11 17.8	317 28.8	N23 15.9	24 49.6	N13 37.1	228 55.9	S 3 35.0
07	78 12.2	281 38.0	16.7	332 29.6	15.8	39 52.0	37.1	243 58.2	35.1
T 08	93 14.7	296 37.6	15.6	347 30.3	15.7	54 54.4	37.2	259 00.4	35.2
H 09	108 17.2	311 37.1	. . 14.5	2 31.0	. . 15.5	69 56.8	. . 37.2	274 02.7	. . 35.3
U 10	123 19.6	326 36.6	13.3	17 31.7	15.4	84 59.3	37.2	289 04.9	35.4
R 11	138 22.1	341 36.1	12.2	32 32.4	15.2	100 01.7	37.2	304 07.1	35.5
S 12	153 24.5	356 35.6	N11 11.1	47 33.1	N23 15.1	115 04.1	N13 37.2	319 09.4	S 3 35.6
D 13	168 27.0	11 35.2	10.0	62 33.9	14.9	130 06.5	37.2	334 11.6	35.7
A 14	183 29.5	26 34.7	08.9	77 34.6	14.8	145 08.9	37.2	349 13.8	35.9
Y 15	198 31.9	41 34.2	. . 07.8	92 35.3	. . 14.7	160 11.4	. . 37.2	4 16.1	. . 36.0
16	213 34.4	56 33.7	06.6	107 36.0	14.5	175 13.8	37.2	19 18.3	36.1
17	228 36.9	71 33.2	05.5	122 36.7	14.4	190 16.2	37.2	34 20.5	36.2
18	243 39.3	86 32.8	N11 04.4	137 37.4	N23 14.2	205 18.6	N13 37.2	49 22.8	S 3 36.3
19	258 41.8	101 32.3	03.3	152 38.2	14.1	220 21.1	37.2	64 25.0	36.4
20	273 44.3	116 31.8	02.2	167 38.9	13.9	235 23.5	37.2	79 27.2	36.5
21	288 46.7	131 31.3	11 01.0	182 39.6	. . 13.8	250 25.9	. . 37.2	94 29.5	. . 36.6
22	303 49.2	146 30.9	10 59.9	197 40.3	13.7	265 28.3	37.2	109 31.7	36.7
23	318 51.7	161 30.4	N10 58.8	212 41.0	13.5	280 30.8	37.2	124 33.9	36.8
	h m								
Mer. Pass.	1 52.0	v −0.5	d 1.1	v 0.7	d 0.1	v 2.4	d 0.0	v 2.2	d 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.2	S40 15.2
Achernar	335 27.3	S57 10.3
Acrux	173 11.4	S63 10.1
Adhara	255 13.8	S28 59.2
Aldebaran	290 50.9	N16 32.0
Alioth	166 22.1	N55 53.9
Alkaid	153 00.1	N49 15.5
Al Na'ir	27 44.8	S46 54.0
Alnilam	275 47.8	S 1 11.6
Alphard	217 57.7	S 8 42.6
Alphecca	126 12.1	N26 40.8
Alpheratz	357 44.5	N29 09.4
Altair	62 09.2	N 8 54.2
Ankaa	353 16.6	S42 14.2
Antares	112 27.8	S26 27.5
Arcturus	145 57.0	N19 07.5
Atria	107 30.6	S69 03.1
Avior	234 19.2	S59 32.7
Bellatrix	278 33.5	N 6 21.6
Betelgeuse	271 02.8	N 7 24.6
Canopus	263 57.0	S52 41.9
Capella	280 36.5	N46 00.4
Deneb	49 31.9	N45 19.6
Denebola	182 35.2	N14 30.4
Diphda	348 56.9	S17 55.1
Dubhe	193 53.8	N61 41.3
Elnath	278 14.4	N28 36.9
Eltanin	90 46.5	N51 29.6
Enif	33 48.0	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.8	S57 10.9
Gienah	175 53.9	S17 36.4
Hadar	148 50.1	S60 26.0
Hamal	328 02.0	N23 31.1
Kaus Aust.	83 45.2	S34 22.7
Kochab	137 20.2	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.3	N 4 08.3
Menkent	148 09.3	S36 25.8
Miaplacidus	221 40.9	S69 45.9
Mirfak	308 42.1	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.6	S56 41.8
Pollux	243 29.6	N27 59.8
Procyon	245 01.3	N 5 11.7
Rasalhague	96 07.5	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.4	S 8 11.2
Rigil Kent.	139 53.7	S60 53.2
Sabik	102 13.9	S15 44.3
Schedar	349 41.6	N56 36.1
Shaula	96 23.5	S37 06.7
Sirius	258 35.1	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.8	S43 28.8
Vega	80 39.6	N38 48.0
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	204 57.3	12 13
Mars	255 11.7	8 51
Jupiter	321 41.3	4 25
Saturn	165 53.0	14 47

UT	SUN			MOON					
	GHA		Dec	GHA	v		Dec	d	HP
d h	° ′		° ′	° ′	′		° ′	′	′
23 00	179 17.6		N11 37.9	260 45.9	9.7		N22 59.8	1.4	55.6
01	194 17.7		37.0	275 14.6	9.6		23 01.2	1.3	55.6
02	209 17.9		36.2	289 43.2	9.6		23 02.5	1.2	55.7
03	224 18.0	. .	35.3	304 11.8	9.6		23 03.7	1.1	55.7
04	239 18.2		34.5	318 40.4	9.5		23 04.8	0.9	55.7
05	254 18.4		33.6	333 08.9	9.4		23 05.7	0.9	55.8
06	269 18.5		N11 32.8	347 37.3	9.4		N23 06.6	0.7	55.8
07	284 18.7		31.9	2 05.7	9.4		23 07.3	0.6	55.8
T 08	299 18.8		31.1	16 34.1	9.3		23 07.9	0.4	55.8
U 09	314 19.0	. .	30.2	31 02.4	9.3		23 08.3	0.4	55.9
E 10	329 19.2		29.4	45 30.7	9.2		23 08.7	0.2	55.9
S 11	344 19.3		28.6	59 58.9	9.2		23 08.9	0.1	55.9
D 12	359 19.5		N11 27.7	74 27.1	9.1		N23 09.0	0.0	56.0
A 13	14 19.7		26.9	88 55.2	9.1		23 09.0	0.2	56.0
Y 14	29 19.8		26.0	103 23.3	9.1		23 08.8	0.2	56.0
15	44 20.0	. .	25.2	117 51.4	9.1		23 08.6	0.4	56.1
16	59 20.1		24.3	132 19.5	9.0		23 08.2	0.5	56.1
17	74 20.3		23.5	146 47.5	8.9		23 07.7	0.7	56.1
18	89 20.5		N11 22.6	161 15.4	8.9		N23 07.0	0.7	56.2
19	104 20.6		21.8	175 43.3	8.9		23 06.3	0.9	56.2
20	119 20.8		20.9	190 11.2	8.9		23 05.4	1.1	56.2
21	134 21.0	. .	20.1	204 39.1	8.8		23 04.3	1.1	56.3
22	149 21.1		19.2	219 06.9	8.8		23 03.2	1.3	56.3
23	164 21.3		18.4	233 34.7	8.7		23 01.9	1.4	56.3
24 00	179 21.5		N11 17.5	248 02.4	8.8		N23 00.5	1.5	56.4
01	194 21.6		16.7	262 30.2	8.7		22 59.0	1.7	56.4
02	209 21.8		15.8	276 57.9	8.6		22 57.3	1.8	56.4
03	224 22.0	. .	15.0	291 25.5	8.7		22 55.5	1.9	56.5
04	239 22.1		14.1	305 53.2	8.6		22 53.6	2.0	56.5
05	254 22.3		13.3	320 20.8	8.6		22 51.6	2.2	56.5
06	269 22.5		N11 12.4	334 48.4	8.5		N22 49.4	2.3	56.6
W 07	284 22.6		11.6	349 15.9	8.6		22 47.1	2.5	56.6
E 08	299 22.8		10.7	3 43.5	8.5		22 44.6	2.5	56.6
D 09	314 23.0	. .	09.8	18 11.0	8.4		22 42.1	2.7	56.7
N 10	329 23.1		09.0	32 38.4	8.5		22 39.4	2.8	56.7
E 11	344 23.3		08.1	47 05.9	8.4		22 36.6	3.0	56.7
S 12	359 23.5		N11 07.3	61 33.3	8.5		N22 33.6	3.1	56.8
D 13	14 23.6		06.4	76 00.8	8.4		22 30.5	3.2	56.8
A 14	29 23.8		05.6	90 28.2	8.3		22 27.3	3.4	56.9
Y 15	44 24.0	. .	04.7	104 55.5	8.4		22 23.9	3.4	56.9
16	59 24.1		03.9	119 22.9	8.3		22 20.5	3.6	56.9
17	74 24.3		03.0	133 50.2	8.4		22 16.9	3.8	57.0
18	89 24.5		N11 02.2	148 17.6	8.3		N22 13.1	3.8	57.0
19	104 24.6		01.3	162 44.9	8.3		22 09.3	4.0	57.0
20	119 24.8		11 00.4	177 12.2	8.3		22 05.3	4.2	57.1
21	134 25.0		10 59.6	191 39.5	8.2		22 01.1	4.2	57.1
22	149 25.1		58.7	206 06.7	8.3		21 56.9	4.4	57.1
23	164 25.3		57.9	220 34.0	8.2		21 52.5	4.5	57.2
25 00	179 25.5		N10 57.0	235 01.2	8.3		N21 48.0	4.7	57.2
01	194 25.6		56.1	249 28.5	8.2		21 43.3	4.8	57.3
02	209 25.8		55.3	263 55.7	8.2		21 38.5	4.9	57.3
03	224 26.0	. .	54.4	278 22.9	8.2		21 33.6	5.0	57.3
04	239 26.1		53.6	292 50.1	8.2		21 28.6	5.2	57.4
05	254 26.3		52.7	307 17.3	8.2		21 23.4	5.3	57.4
06	269 26.5		N10 51.9	321 44.5	8.2		N21 18.1	5.4	57.4
07	284 26.7		51.0	336 11.7	8.2		21 12.7	5.6	57.5
T 08	299 26.8		50.1	350 38.9	8.2		21 07.1	5.7	57.5
H 09	314 27.0	. .	49.3	5 06.1	8.1		21 01.4	5.8	57.6
U 10	329 27.2		48.4	19 33.2	8.2		20 55.6	6.0	57.6
R 11	344 27.3		47.5	34 00.4	8.2		20 49.6	6.0	57.6
S 12	359 27.5		N10 46.7	48 27.6	8.1		N20 43.6	6.2	57.7
D 13	14 27.7		45.8	62 54.7	8.2		20 37.4	6.4	57.7
A 14	29 27.9		45.0	77 21.9	8.2		20 31.0	6.4	57.7
Y 15	44 28.0	. .	44.1	91 49.1	8.2		20 24.6	6.6	57.8
16	59 28.2		43.2	106 16.3	8.1		20 18.0	6.7	57.8
17	74 28.4		42.4	120 43.4	8.2		20 11.3	6.9	57.9
18	89 28.5		N10 41.5	135 10.6	8.2		N20 04.4	6.9	57.9
19	104 28.7		40.6	149 37.8	8.2		19 57.5	7.1	57.9
20	119 28.9		39.8	164 05.0	8.2		19 50.4	7.3	58.0
21	134 29.1	. .	38.9	178 32.2	8.2		19 43.1	7.3	58.0
22	149 29.2		38.1	192 59.4	8.1		19 35.8	7.5	58.0
23	164 29.4		37.2	207 26.5	8.3		N19 28.3	7.6	58.1
	SD 15.8		d 0.9	SD 15.3			15.5		15.7

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		23	24	25	26
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	01 09	03 17	▭	▭	▭	▭
N 70	////	02 06	03 38	▭	▭	22 04	24 49
68	////	02 39	03 54	▭	20 32	23 10	25 16
66	01 00	03 02	04 07	20 32	21 59	23 46	25 37
64	01 50	03 20	04 18	21 21	22 37	24 11	00 11
62	02 20	03 35	04 27	21 52	23 04	24 31	00 31
60	02 42	03 47	04 35	22 16	23 24	24 47	00 47
N 58	02 59	03 57	04 42	22 34	23 41	25 00	01 00
56	03 13	04 06	04 48	22 50	23 55	25 12	01 12
54	03 25	04 14	04 53	23 04	24 08	00 08	01 22
52	03 35	04 21	04 58	23 15	24 19	00 19	01 31
50	03 44	04 28	05 02	23 26	24 28	00 28	01 39
45	04 03	04 41	05 12	23 48	24 49	00 49	01 57
N 40	04 17	04 51	05 20	24 05	00 05	01 05	02 11
35	04 29	05 00	05 26	24 20	00 20	01 19	02 22
30	04 38	05 08	05 32	24 33	00 33	01 31	02 33
20	04 53	05 20	05 42	00 02	00 55	01 51	02 51
N 10	05 05	05 30	05 51	00 21	01 14	02 09	03 06
0	05 14	05 38	05 59	00 39	01 32	02 26	03 20
S 10	05 21	05 46	06 07	00 57	01 49	02 42	03 35
20	05 27	05 53	06 15	01 16	02 08	03 00	03 50
30	05 33	06 01	06 25	01 38	02 30	03 21	04 07
35	05 35	06 04	06 30	01 51	02 43	03 32	04 18
40	05 37	06 09	06 36	02 06	02 58	03 46	04 29
45	05 39	06 13	06 43	02 23	03 16	04 02	04 43
S 50	05 41	06 19	06 52	02 45	03 38	04 22	04 59
52	05 42	06 21	06 55	02 56	03 48	04 31	05 07
54	05 42	06 23	07 00	03 08	04 00	04 42	05 16
56	05 43	06 26	07 04	03 22	04 13	04 54	05 25
58	05 44	06 29	07 10	03 38	04 29	05 08	05 36
S 60	05 44	06 32	07 15	03 57	04 47	05 24	05 49

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	23	24	25	26
°	h m	h m	h m	h m	h m	h m	h m
N 72	20 43	22 43	////	▭	▭	▭	20 11
N 70	20 23	21 53	////	▭	▭	20 21	19 29
68	20 08	21 22	////	▭	19 57	19 14	19 01
66	19 55	20 59	22 54	18 05	18 30	18 38	18 39
64	19 45	20 42	22 09	17 16	17 52	18 12	18 22
62	19 36	20 28	21 41	16 44	17 25	17 51	18 08
60	19 28	20 16	21 20	16 21	17 04	17 34	17 56
N 58	19 22	20 06	21 03	16 02	16 47	17 20	17 45
56	19 16	19 57	20 50	15 46	16 32	17 08	17 36
54	19 11	19 49	20 38	15 33	16 20	16 58	17 28
52	19 06	19 42	20 28	15 21	16 09	16 48	17 20
50	19 01	19 36	20 19	15 11	15 59	16 40	17 14
45	18 52	19 23	20 01	14 49	15 38	16 21	16 59
N 40	18 45	19 13	19 47	14 31	15 21	16 07	16 47
35	18 38	19 04	19 35	14 16	15 07	15 54	16 37
30	18 32	18 57	19 26	14 03	14 55	15 43	16 28
20	18 22	18 45	19 11	13 41	14 33	15 24	16 13
N 10	18 14	18 35	19 00	13 22	14 15	15 07	15 59
0	18 06	18 27	18 51	13 04	13 57	14 52	15 46
S 10	17 58	18 19	18 44	12 46	13 40	14 36	15 33
20	17 50	18 12	18 38	12 27	13 21	14 19	15 19
30	17 40	18 05	18 33	12 05	13 00	14 00	15 03
35	17 35	18 01	18 30	11 52	12 47	13 49	14 54
40	17 29	17 57	18 28	11 37	12 33	13 35	14 43
45	17 22	17 52	18 26	11 19	12 15	13 20	14 31
S 50	17 14	17 47	18 25	10 57	11 54	13 01	14 15
52	17 10	17 45	18 24	10 46	11 44	12 52	14 08
54	17 06	17 42	18 24	10 34	11 32	12 42	14 00
56	17 01	17 40	18 23	10 20	11 19	12 30	13 51
58	16 56	17 37	18 23	10 04	11 03	12 17	13 40
S 60	16 50	17 34	18 22	09 45	10 45	12 01	13 28

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
23	02 50	02 42	12 03	06 51	19 18	24	35
24	02 34	02 27	12 02	07 45	20 12	25	25
25	02 18	02 10	12 02	08 39	21 06	26	17

UT	ARIES	VENUS −4.0		MARS +1.4		JUPITER −2.6		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
26 00	333 54.1	176 29.9	N10 57.7	227 41.7	N23 13.4	295 33.2	N13 37.2	139 36.2	S 3 36.9
01	348 56.6	191 29.4	56.6	242 42.5	13.2	310 35.6	37.2	154 38.4	37.0
02	3 59.0	206 29.0	55.4	257 43.2	13.1	325 38.0	37.2	169 40.6	37.1
03	19 01.5	221 28.5	54.3	272 43.9	12.9	340 40.5	37.2	184 42.9	37.2
04	34 04.0	236 28.0	53.2	287 44.6	12.8	355 42.9	37.2	199 45.1	37.3
05	49 06.4	251 27.5	52.1	302 45.3	12.6	10 45.3	37.2	214 47.3	37.4
06	64 08.9	266 27.1	N10 50.9	317 46.1	N23 12.5	25 47.7	N13 37.2	229 49.6	S 3 37.5
07	79 11.4	281 26.6	49.8	332 46.8	12.3	40 50.2	37.2	244 51.8	37.6
08	94 13.8	296 26.1	48.7	347 47.5	12.2	55 52.6	37.2	259 54.0	37.7
F 09	109 16.3	311 25.6	47.5	2 48.2	12.0	70 55.0	37.2	274 56.3	37.8
R 10	124 18.8	326 25.2	46.4	17 48.9	11.9	85 57.4	37.2	289 58.5	37.9
I 11	139 21.2	341 24.7	45.3	32 49.7	11.7	100 59.9	37.2	305 00.7	38.0
D 12	154 23.7	356 24.2	N10 44.2	47 50.4	N23 11.6	116 02.3	N13 37.2	320 03.0	S 3 38.1
A 13	169 26.2	11 23.8	43.0	62 51.1	11.4	131 04.7	37.2	335 05.2	38.2
Y 14	184 28.6	26 23.3	41.9	77 51.8	11.3	146 07.2	37.2	350 07.4	38.3
15	199 31.1	41 22.8	40.8	92 52.5	11.1	161 09.6	37.2	5 09.7	38.4
16	214 33.5	56 22.3	39.6	107 53.3	11.0	176 12.0	37.2	20 11.9	38.5
17	229 36.0	71 21.9	38.5	122 54.0	10.8	191 14.5	37.2	35 14.1	38.6
18	244 38.5	86 21.4	N10 37.4	137 54.7	N23 10.7	206 16.9	N13 37.2	50 16.3	S 3 38.7
19	259 40.9	101 20.9	36.2	152 55.4	10.5	221 19.3	37.3	65 18.6	38.8
20	274 43.4	116 20.5	35.1	167 56.1	10.4	236 21.8	37.3	80 20.8	38.9
21	289 45.9	131 20.0	34.0	182 56.9	10.2	251 24.2	37.3	95 23.0	39.0
22	304 48.3	146 19.5	32.8	197 57.6	10.1	266 26.6	37.3	110 25.3	39.1
23	319 50.8	161 19.1	31.7	212 58.3	09.9	281 29.1	37.3	125 27.5	39.2
27 00	334 53.3	176 18.6	N10 30.6	227 59.0	N23 09.8	296 31.5	N13 37.3	140 29.7	S 3 39.3
01	349 55.7	191 18.1	29.4	242 59.8	09.6	311 33.9	37.3	155 32.0	39.4
02	4 58.2	206 17.7	28.3	258 00.5	09.5	326 36.4	37.3	170 34.2	39.5
03	20 00.6	221 17.2	27.2	273 01.2	09.3	341 38.8	37.3	185 36.4	39.7
04	35 03.1	236 16.7	26.0	288 01.9	09.2	356 41.2	37.3	200 38.7	39.8
05	50 05.6	251 16.3	24.9	303 02.7	09.0	11 43.7	37.3	215 40.9	39.9
06	65 08.0	266 15.8	N10 23.8	318 03.4	N23 08.9	26 46.1	N13 37.3	230 43.1	S 3 40.0
07	80 10.5	281 15.3	22.6	333 04.1	08.7	41 48.5	37.3	245 45.4	40.1
S 08	95 13.0	296 14.9	21.5	348 04.8	08.5	56 51.0	37.3	260 47.6	40.2
A 09	110 15.4	311 14.4	20.3	3 05.5	08.4	71 53.4	37.3	275 49.8	40.3
T 10	125 17.9	326 13.9	19.2	18 06.3	08.2	86 55.8	37.3	290 52.0	40.4
U 11	140 20.4	341 13.5	18.1	33 07.0	08.1	101 58.3	37.3	305 54.3	40.5
R 12	155 22.8	356 13.0	N10 16.9	48 07.7	N23 07.9	117 00.7	N13 37.3	320 56.5	S 3 40.6
D 13	170 25.3	11 12.6	15.8	63 08.5	07.8	132 03.1	37.3	335 58.7	40.7
A 14	185 27.8	26 12.1	14.6	78 09.2	07.6	147 05.6	37.2	351 01.0	40.8
Y 15	200 30.2	41 11.6	13.5	93 09.9	07.5	162 08.0	37.2	6 03.2	40.9
16	215 32.7	56 11.2	12.4	108 10.6	07.3	177 10.5	37.2	21 05.4	41.0
17	230 35.1	71 10.7	11.2	123 11.4	07.1	192 12.9	37.2	36 07.7	41.1
18	245 37.6	86 10.2	N10 10.1	138 12.1	N23 07.0	207 15.3	N13 37.2	51 09.9	S 3 41.2
19	260 40.1	101 09.8	08.9	153 12.8	06.8	222 17.8	37.2	66 12.1	41.3
20	275 42.5	116 09.3	07.8	168 13.5	06.7	237 20.2	37.2	81 14.3	41.4
21	290 45.0	131 08.9	06.6	183 14.3	06.5	252 22.7	37.2	96 16.6	41.5
22	305 47.5	146 08.4	05.5	198 15.0	06.3	267 25.1	37.2	111 18.8	41.6
23	320 49.9	161 08.0	04.3	213 15.7	06.2	282 27.5	37.2	126 21.0	41.7
28 00	335 52.4	176 07.5	N10 03.2	228 16.4	N23 06.0	297 30.0	N13 37.2	141 23.3	S 3 41.8
01	350 54.9	191 07.0	02.1	243 17.2	05.9	312 32.4	37.2	156 25.5	41.9
02	5 57.3	206 06.6	10 00.9	258 17.9	05.7	327 34.9	37.2	171 27.7	42.0
03	20 59.8	221 06.1	9 59.8	273 18.6	05.5	342 37.3	37.2	186 30.0	42.1
04	36 02.3	236 05.7	58.6	288 19.4	05.4	357 39.8	37.2	201 32.2	42.2
05	51 04.7	251 05.2	57.5	303 20.1	05.2	12 42.2	37.2	216 34.4	42.3
06	66 07.2	266 04.7	N 9 56.3	318 20.8	N23 05.1	27 44.6	N13 37.2	231 36.6	S 3 42.5
07	81 09.6	281 04.3	55.2	333 21.5	04.9	42 47.1	37.2	246 38.9	42.6
08	96 12.1	296 03.8	54.0	348 22.3	04.7	57 49.5	37.2	261 41.1	42.7
S 09	111 14.6	311 03.4	52.9	3 23.0	04.6	72 52.0	37.2	276 43.3	42.8
U 10	126 17.0	326 02.9	51.7	18 23.7	04.4	87 54.4	37.2	291 45.6	42.9
N 11	141 19.5	341 02.5	50.6	33 24.5	04.3	102 56.9	37.2	306 47.8	43.0
D 12	156 22.0	356 02.0	N 9 49.4	48 25.2	N23 04.1	117 59.3	N13 37.2	321 50.0	S 3 43.1
A 13	171 24.4	11 01.6	48.3	63 25.9	03.9	133 01.8	37.2	336 52.2	43.2
Y 14	186 26.9	26 01.1	47.1	78 26.7	03.8	148 04.2	37.2	351 54.5	43.3
15	201 29.4	41 00.7	45.9	93 27.4	03.6	163 06.6	37.2	6 56.7	43.4
16	216 31.8	56 00.2	44.8	108 28.1	03.4	178 09.1	37.2	21 58.9	43.5
17	231 34.3	70 59.7	43.6	123 28.9	03.3	193 11.5	37.2	37 01.2	43.6
18	246 36.7	85 59.3	N 9 42.5	138 29.6	N23 03.1	208 14.0	N13 37.2	52 03.4	S 3 43.7
19	261 39.2	100 58.8	41.3	153 30.3	02.9	223 16.4	37.2	67 05.6	43.8
20	276 41.7	115 58.4	40.2	168 31.0	02.8	238 18.9	37.2	82 07.8	43.9
21	291 44.1	130 57.9	39.0	183 31.8	02.6	253 21.3	37.2	97 10.1	44.0
22	306 46.6	145 57.5	37.9	198 32.5	02.4	268 23.8	37.2	112 12.3	44.1
23	321 49.1	160 57.0	36.7	213 33.2	02.3	283 26.2	37.2	127 14.5	44.2
	h m								
Mer. Pass.	1 40.2	v −0.5	d 1.1	v 0.7	d 0.2	v 2.4	d 0.0	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.1	S40 15.1
Achernar	335 27.3	S57 10.3
Acrux	173 11.4	S63 10.0
Adhara	255 13.8	S28 59.1
Aldebaran	290 50.9	N16 32.0
Alioth	166 22.1	N55 53.9
Alkaid	153 00.1	N49 15.5
Al Na'ir	27 44.8	S46 54.0
Alnilam	275 47.8	S 1 11.6
Alphard	217 57.6	S 8 42.6
Alphecca	126 12.1	N26 40.8
Alpheratz	357 44.5	N29 09.4
Altair	62 09.2	N 8 54.2
Ankaa	353 16.5	S42 14.2
Antares	112 27.8	S26 27.5
Arcturus	145 57.0	N19 07.4
Atria	107 30.6	S69 03.1
Avior	234 19.1	S59 32.7
Bellatrix	278 33.5	N 6 21.6
Betelgeuse	271 02.8	N 7 24.6
Canopus	263 57.0	S52 41.9
Capella	280 36.4	N46 00.4
Deneb	49 31.9	N45 19.6
Denebola	182 35.2	N14 30.4
Diphda	348 56.9	S17 55.1
Dubhe	193 53.8	N61 41.3
Elnath	278 14.3	N28 36.9
Eltanin	90 46.5	N51 29.6
Enif	33 48.0	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.9
Gienah	175 53.9	S17 36.4
Hadar	148 50.1	S60 26.0
Hamal	328 02.0	N23 31.1
Kaus Aust.	83 45.3	S34 22.7
Kochab	137 20.2	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.3	N 4 08.3
Menkent	148 09.3	S36 25.8
Miaplacidus	221 40.9	S69 45.9
Mirfak	308 42.1	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.6	S56 41.8
Pollux	243 29.5	N27 59.8
Procyon	245 01.3	N 5 11.7
Rasalhague	96 07.5	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.4	S 8 11.2
Rigil Kent.	139 53.8	S60 53.2
Sabik	102 13.9	S15 44.3
Schedar	349 41.6	N56 36.1
Shaula	96 23.5	S37 06.7
Sirius	258 35.0	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.8	S43 28.8
Vega	80 39.6	N38 48.0
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	201 25.3	12 15
Mars	253 05.8	8 48
Jupiter	321 38.2	4 13
Saturn	165 36.5	14 36

2011 AUGUST 26, 27, 28 (FRI., SAT., SUN.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
26 00	179 29.6	N10 36.3	221 53.8	8.2	N19 20.7	7.7	58.1
01	194 29.8	35.5	236 21.0	8.2	19 13.0	7.8	58.2
02	209 29.9	34.6	250 48.2	8.2	19 05.2	8.0	58.2
03	224 30.1	33.7	265 15.4	8.2	18 57.2	8.0	58.2
04	239 30.3	32.9	279 42.6	8.3	18 49.2	8.2	58.3
05	254 30.4	32.0	294 09.9	8.2	18 41.0	8.4	58.3
06	269 30.6	N10 31.1	308 37.1	8.3	N18 32.6	8.4	58.3
07	284 30.8	30.3	323 04.4	8.3	18 24.2	8.6	58.4
08	299 31.0	29.4	337 31.7	8.3	18 15.6	8.6	58.4
F 09	314 31.1	28.5	351 59.0	8.3	18 07.0	8.8	58.5
R 10	329 31.3	27.7	6 26.3	8.3	17 58.2	8.9	58.5
I 11	344 31.5	26.8	20 53.6	8.3	17 49.3	9.1	58.5
D 12	359 31.7	N10 25.9	35 20.9	8.3	N17 40.2	9.1	58.6
A 13	14 31.8	25.0	49 48.2	8.4	17 31.1	9.3	58.6
Y 14	29 32.0	24.2	64 15.6	8.3	17 21.8	9.4	58.6
15	44 32.2	23.3	78 42.9	8.4	17 12.4	9.4	58.7
16	59 32.4	22.4	93 10.3	8.4	17 03.0	9.6	58.7
17	74 32.5	21.6	107 37.7	8.4	16 53.4	9.7	58.7
18	89 32.7	N10 20.7	122 05.1	8.4	N16 43.7	9.9	58.8
19	104 32.9	19.8	136 32.5	8.4	16 33.8	9.9	58.8
20	119 33.1	19.0	150 59.9	8.5	16 23.9	10.0	58.9
21	134 33.3	18.1	165 27.4	8.4	16 13.9	10.2	58.9
22	149 33.4	17.2	179 54.8	8.5	16 03.7	10.2	58.9
23	164 33.6	16.3	194 22.3	8.5	15 53.5	10.4	59.0
27 00	179 33.8	N10 15.5	208 49.8	8.5	N15 43.1	10.5	59.0
01	194 34.0	14.6	223 17.3	8.5	15 32.6	10.5	59.0
02	209 34.1	13.7	237 44.8	8.6	15 22.1	10.7	59.1
03	224 34.3	12.8	252 12.4	8.5	15 11.4	10.8	59.1
04	239 34.5	12.0	266 39.9	8.6	15 00.6	10.9	59.1
05	254 34.7	11.1	281 07.5	8.6	14 49.7	10.9	59.2
06	269 34.9	N10 10.2	295 35.1	8.6	N14 38.8	11.1	59.2
07	284 35.0	09.4	310 02.7	8.6	14 27.7	11.2	59.2
S 08	299 35.2	08.5	324 30.3	8.7	14 16.5	11.3	59.3
A 09	314 35.4	07.6	338 58.0	8.6	14 05.2	11.3	59.3
T 10	329 35.6	06.7	353 25.6	8.7	13 53.9	11.5	59.3
U 11	344 35.7	05.9	7 53.3	8.7	13 42.4	11.6	59.4
R 12	359 35.9	N10 05.0	22 21.0	8.7	N13 30.8	11.6	59.4
D 13	14 36.1	04.1	36 48.7	8.7	13 19.2	11.8	59.4
A 14	29 36.3	03.2	51 16.4	8.8	13 07.4	11.8	59.5
Y 15	44 36.5	02.4	65 44.2	8.8	12 55.6	11.9	59.5
16	59 36.6	01.5	80 12.0	8.7	12 43.7	12.0	59.5
17	74 36.8	10 00.6	94 39.7	8.8	12 31.7	12.1	59.6
18	89 37.0	N 9 59.7	109 07.5	8.8	N12 19.6	12.2	59.6
19	104 37.2	58.8	123 35.3	8.9	12 07.4	12.3	59.6
20	119 37.4	58.0	138 03.2	8.8	11 55.1	12.3	59.6
21	134 37.5	57.1	152 31.0	8.9	11 42.8	12.4	59.7
22	149 37.7	56.2	166 58.9	8.8	11 30.4	12.6	59.7
23	164 37.9	55.3	181 26.7	8.9	11 17.8	12.5	59.7
28 00	179 38.1	N 9 54.5	195 54.6	8.9	N11 05.3	12.7	59.8
01	194 38.3	53.6	210 22.5	8.9	10 52.6	12.8	59.8
02	209 38.4	52.7	224 50.4	9.0	10 39.8	12.8	59.8
03	224 38.6	51.8	239 18.4	8.9	10 27.0	12.9	59.9
04	239 38.8	50.9	253 46.3	9.0	10 14.1	12.9	59.9
05	254 39.0	50.1	268 14.3	8.9	10 01.2	13.1	59.9
06	269 39.2	N 9 49.2	282 42.2	9.0	N 9 48.1	13.1	59.9
07	284 39.4	48.3	297 10.2	9.0	9 35.0	13.1	60.0
08	299 39.5	47.4	311 38.2	9.0	9 21.9	13.3	60.0
S 09	314 39.7	46.5	326 06.2	9.1	9 08.6	13.3	60.0
U 10	329 39.9	45.6	340 34.3	9.0	8 55.3	13.4	60.0
N 11	344 40.1	44.8	355 02.3	9.1	8 41.9	13.4	60.1
D 12	359 40.3	N 9 43.9	9 30.4	9.0	N 8 28.5	13.5	60.1
A 13	14 40.5	43.0	23 58.4	9.1	8 15.0	13.6	60.1
Y 14	29 40.6	42.1	38 26.5	9.1	8 01.4	13.6	60.1
15	44 40.8	41.2	52 54.6	9.1	7 47.8	13.6	60.2
16	59 41.0	40.4	67 22.7	9.1	7 34.2	13.8	60.2
17	74 41.2	39.5	81 50.8	9.1	7 20.4	13.7	60.2
18	89 41.4	N 9 38.6	96 18.9	9.1	N 7 06.7	13.9	60.2
19	104 41.6	37.7	110 47.0	9.1	6 52.8	13.8	60.2
20	119 41.7	36.8	125 15.1	9.2	6 39.0	14.0	60.3
21	134 41.9	35.9	139 43.3	9.1	6 25.0	13.9	60.3
22	149 42.1	35.0	154 11.4	9.1	6 11.1	14.1	60.3
23	164 42.3	34.2	168 39.5	9.2	N 5 57.0	14.0	60.3
	SD 15.9	d 0.9	SD 16.0		16.2		16.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 26	Moonrise 27	Moonrise 28	Moonrise 29
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	01 45	03 34	▭	00 10	02 46	05 04
N 70	////	02 27	03 52	24 49	00 49	03 03	05 11
68	////	02 54	04 06	25 16	01 16	03 17	05 16
66	01 31	03 15	04 17	25 37	01 37	03 29	05 20
64	02 08	03 31	04 27	00 11	01 53	03 38	05 24
62	02 33	03 44	04 35	00 31	02 06	03 46	05 27
60	02 53	03 55	04 42	00 47	02 18	03 53	05 30
N 58	03 08	04 05	04 48	01 00	02 28	03 59	05 32
56	03 21	04 13	04 54	01 12	02 36	04 04	05 34
54	03 32	04 20	04 58	01 22	02 44	04 09	05 36
52	03 42	04 27	05 03	01 31	02 50	04 13	05 38
50	03 50	04 32	05 07	01 39	02 57	04 17	05 40
45	04 07	04 45	05 15	01 57	03 10	04 26	05 43
N 40	04 21	04 54	05 23	02 11	03 20	04 32	05 46
35	04 31	05 02	05 29	02 22	03 29	04 38	05 48
30	04 40	05 09	05 34	02 33	03 37	04 44	05 51
20	04 54	05 21	05 43	02 51	03 51	04 53	05 54
N 10	05 05	05 30	05 51	03 06	04 03	05 01	05 58
0	05 13	05 37	05 58	03 20	04 14	05 08	06 01
S 10	05 20	05 44	06 05	03 35	04 26	05 15	06 04
20	05 25	05 51	06 13	03 50	04 38	05 23	06 07
30	05 29	05 57	06 22	04 07	04 51	05 32	06 11
35	05 31	06 01	06 26	04 18	04 59	05 37	06 13
40	05 33	06 04	06 32	04 29	05 08	05 43	06 16
45	05 34	06 08	06 38	04 43	05 18	05 50	06 19
S 50	05 35	06 13	06 46	04 59	05 31	05 58	06 22
52	05 36	06 15	06 49	05 07	05 36	06 01	06 24
54	05 36	06 17	06 53	05 16	05 43	06 05	06 25
56	05 36	06 19	06 57	05 25	05 50	06 10	06 27
58	05 36	06 22	07 02	05 36	05 58	06 15	06 29
S 60	05 36	06 24	07 07	05 49	06 07	06 20	06 32

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 26	Moonset 27	Moonset 28	Moonset 29
°	h m	h m	h m	h m	h m	h m	h m
N 72	20 26	22 09	////	20 11	19 28	19 02	18 40
N 70	20 08	21 31	////	19 29	19 08	18 52	18 39
68	19 55	21 05	23 41	19 01	18 52	18 45	18 38
66	19 44	20 45	22 25	18 39	18 39	18 38	18 37
64	19 34	20 30	21 50	18 22	18 28	18 33	18 36
62	19 26	20 17	21 26	18 08	18 19	18 28	18 35
60	19 20	20 06	21 08	17 56	18 11	18 24	18 34
N 58	19 14	19 57	20 53	17 45	18 04	18 20	18 34
56	19 08	19 49	20 40	17 36	17 58	18 16	18 33
54	19 04	19 41	20 29	17 28	17 52	18 13	18 33
52	18 59	19 35	20 20	17 20	17 47	18 11	18 32
50	18 55	19 30	20 12	17 14	17 43	18 08	18 32
45	18 47	19 18	19 55	16 59	17 32	18 03	18 31
N 40	18 40	19 08	19 42	16 47	17 24	17 58	18 30
35	18 34	19 00	19 31	16 37	17 17	17 54	18 29
30	18 29	18 53	19 22	16 28	17 10	17 50	18 29
20	18 20	18 42	19 09	16 13	16 59	17 44	18 28
N 10	18 12	18 33	18 58	15 59	16 49	17 38	18 27
0	18 05	18 26	18 50	15 46	16 40	17 33	18 26
S 10	17 58	18 19	18 44	15 33	16 31	17 28	18 25
20	17 50	18 13	18 38	15 19	16 20	17 22	18 24
30	17 42	18 06	18 34	15 03	16 09	17 15	18 23
35	17 37	18 03	18 32	14 54	16 02	17 12	18 22
40	17 32	17 59	18 31	14 43	15 54	17 07	18 21
45	17 26	17 56	18 30	14 31	15 45	17 02	18 20
S 50	17 18	17 51	18 29	14 15	15 34	16 56	18 19
52	17 15	17 49	18 29	14 08	15 29	16 53	18 18
54	17 11	17 47	18 28	14 00	15 24	16 50	18 18
56	17 07	17 45	18 28	13 51	15 17	16 47	18 17
58	17 03	17 43	18 28	13 40	15 10	16 43	18 16
S 60	16 57	17 40	18 28	13 28	15 02	16 38	18 16

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
26	02 02	01 54	12 02	09 33	22 00	27	9
27	01 45	01 37	12 02	10 27	22 54	28	4
28	01 28	01 19	12 01	11 21	23 47	29	1

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.6		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
29 00	336 51.5	175 56.6	N 9 35.5	228 34.0	N23 02.1	298 28.7	N13 37.2	142 16.7	S 3 44.3
01	351 54.0	190 56.1	34.4	243 34.7	01.9	313 31.1	37.1	157 19.0	44.4
02	6 56.5	205 55.7	33.2	258 35.4	01.8	328 33.6	37.1	172 21.2	44.5
03	21 58.9	220 55.2	32.1	273 36.2	01.6	343 36.0	37.1	187 23.4	44.6
04	37 01.4	235 54.8	30.9	288 36.9	01.4	358 38.5	37.1	202 25.7	44.7
05	52 03.9	250 54.3	29.7	303 37.6	01.3	13 40.9	37.1	217 27.9	44.8
06	67 06.3	265 53.9	N 9 28.6	318 38.4	N23 01.1	28 43.4	N13 37.1	232 30.1	S 3 45.0
07	82 08.8	280 53.4	27.4	333 39.1	00.9	43 45.8	37.1	247 32.3	45.1
08	97 11.2	295 53.0	26.3	348 39.8	00.8	58 48.3	37.1	262 34.6	45.2
M 09	112 13.7	310 52.5	25.1	3 40.6	00.6	73 50.7	37.1	277 36.8	45.3
O 10	127 16.2	325 52.1	23.9	18 41.3	00.4	88 53.2	37.1	292 39.0	45.4
N 11	142 18.6	340 51.6	22.8	33 42.1	00.3	103 55.7	37.1	307 41.2	45.5
D 12	157 21.1	355 51.2	N 9 21.6	48 42.8	N23 00.1	118 58.1	N13 37.1	322 43.5	S 3 45.6
A 13	172 23.6	10 50.8	20.5	63 43.5	22 59.9	134 00.6	37.1	337 45.7	45.7
Y 14	187 26.0	25 50.3	19.3	78 44.3	59.8	149 03.0	37.1	352 47.9	45.8
15	202 28.5	40 49.9	18.1	93 45.0	59.6	164 05.5	37.1	7 50.1	45.9
16	217 31.0	55 49.4	17.0	108 45.7	59.4	179 07.9	37.1	22 52.4	46.0
17	232 33.4	70 49.0	15.8	123 46.5	59.2	194 10.4	37.1	37 54.6	46.1
18	247 35.9	85 48.5	N 9 14.6	138 47.2	N22 59.1	209 12.8	N13 37.0	52 56.8	S 3 46.2
19	262 38.3	100 48.1	13.5	153 47.9	58.9	224 15.3	37.0	67 59.1	46.3
20	277 40.8	115 47.6	12.3	168 48.7	58.7	239 17.7	37.0	83 01.3	46.4
21	292 43.3	130 47.2	11.1	183 49.4	58.6	254 20.2	37.0	98 03.5	46.5
22	307 45.7	145 46.8	10.0	198 50.2	58.4	269 22.7	37.0	113 05.7	46.6
23	322 48.2	160 46.3	08.8	213 50.9	58.2	284 25.1	37.0	128 08.0	46.7
30 00	337 50.7	175 45.9	N 9 07.6	228 51.6	N22 58.0	299 27.6	N13 37.0	143 10.2	S 3 46.8
01	352 53.1	190 45.4	06.5	243 52.4	57.9	314 30.0	37.0	158 12.4	46.9
02	7 55.6	205 45.0	05.3	258 53.1	57.7	329 32.5	37.0	173 14.6	47.1
03	22 58.1	220 44.5	04.1	273 53.8	57.5	344 35.0	37.0	188 16.9	47.2
04	38 00.5	235 44.1	02.9	288 54.6	57.3	359 37.4	37.0	203 19.1	47.3
05	53 03.0	250 43.7	01.8	303 55.3	57.2	14 39.9	37.0	218 21.3	47.4
06	68 05.5	265 43.2	N 9 00.6	318 56.1	N22 57.0	29 42.3	N13 37.0	233 23.5	S 3 47.5
07	83 07.9	280 42.8	8 59.4	333 56.8	56.8	44 44.8	37.0	248 25.8	47.6
T 08	98 10.4	295 42.3	58.3	348 57.5	56.6	59 47.3	36.9	263 28.0	47.7
U 09	113 12.8	310 41.9	57.1	3 58.3	56.5	74 49.7	36.9	278 30.2	47.8
E 10	128 15.3	325 41.5	55.9	18 59.0	56.3	89 52.2	36.9	293 32.4	47.9
S 11	143 17.8	340 41.0	54.7	33 59.8	56.1	104 54.6	36.9	308 34.7	48.0
D 12	158 20.2	355 40.6	N 8 53.6	49 00.5	N22 55.9	119 57.1	N13 36.9	323 36.9	S 3 48.1
A 13	173 22.7	10 40.1	52.4	64 01.2	55.8	134 59.6	36.9	338 39.1	48.2
Y 14	188 25.2	25 39.7	51.2	79 02.0	55.6	150 02.0	36.9	353 41.3	48.3
15	203 27.6	40 39.3	50.0	94 02.7	55.4	165 04.5	36.9	8 43.6	48.4
16	218 30.1	55 38.8	48.9	109 03.5	55.2	180 06.9	36.9	23 45.8	48.5
17	233 32.6	70 38.4	47.7	124 04.2	55.0	195 09.4	36.9	38 48.0	48.6
18	248 35.0	85 37.9	N 8 46.5	139 05.0	N22 54.9	210 11.9	N13 36.9	53 50.2	S 3 48.7
19	263 37.5	100 37.5	45.3	154 05.7	54.7	225 14.3	36.8	68 52.4	48.8
20	278 39.9	115 37.1	44.2	169 06.4	54.5	240 16.8	36.8	83 54.7	48.9
21	293 42.4	130 36.6	43.0	184 07.2	54.3	255 19.3	36.8	98 56.9	49.1
22	308 44.9	145 36.2	41.8	199 07.9	54.1	270 21.7	36.8	113 59.1	49.2
23	323 47.3	160 35.8	40.6	214 08.7	54.0	285 24.2	36.8	129 01.3	49.3
31 00	338 49.8	175 35.3	N 8 39.5	229 09.4	N22 53.8	300 26.7	N13 36.8	144 03.6	S 3 49.4
01	353 52.3	190 34.9	38.3	244 10.2	53.6	315 29.1	36.8	159 05.8	49.5
02	8 54.7	205 34.5	37.1	259 10.9	53.4	330 31.6	36.8	174 08.0	49.6
03	23 57.2	220 34.0	35.9	274 11.6	53.2	345 34.1	36.8	189 10.2	49.7
04	38 59.7	235 33.6	34.7	289 12.4	53.1	0 36.5	36.8	204 12.5	49.8
05	54 02.1	250 33.2	33.6	304 13.1	52.9	15 39.0	36.7	219 14.7	49.9
06	69 04.6	265 32.7	N 8 32.4	319 13.9	N22 52.7	30 41.5	N13 36.7	234 16.9	S 3 50.0
W 07	84 07.1	280 32.3	31.2	334 14.6	52.5	45 43.9	36.7	249 19.1	50.1
E 08	99 09.5	295 31.9	30.0	349 15.4	52.3	60 46.4	36.7	264 21.4	50.2
D 09	114 12.0	310 31.4	28.8	4 16.1	52.2	75 48.9	36.7	279 23.6	50.3
N 10	129 14.4	325 31.0	27.7	19 16.9	52.0	90 51.3	36.7	294 25.8	50.4
E 11	144 16.9	340 30.6	26.5	34 17.6	51.8	105 53.8	36.7	309 28.0	50.5
S 12	159 19.4	355 30.1	N 8 25.3	49 18.3	N22 51.6	120 56.3	N13 36.7	324 30.2	S 3 50.6
D 13	174 21.8	10 29.7	24.1	64 19.1	51.4	135 58.8	36.7	339 32.5	50.7
A 14	189 24.3	25 29.3	22.9	79 19.8	51.2	151 01.2	36.6	354 34.7	50.9
Y 15	204 26.8	40 28.8	21.7	94 20.6	51.1	166 03.7	36.6	9 36.9	51.0
16	219 29.2	55 28.4	20.5	109 21.3	50.9	181 06.2	36.6	24 39.1	51.1
17	234 31.7	70 28.0	19.4	124 22.1	50.7	196 08.6	36.6	39 41.4	51.2
18	249 34.2	85 27.5	N 8 18.2	139 22.8	N22 50.5	211 11.1	N13 36.6	54 43.6	S 3 51.3
19	264 36.6	100 27.1	17.0	154 23.6	50.3	226 13.6	36.6	69 45.8	51.4
20	279 39.1	115 26.7	15.8	169 24.3	50.1	241 16.1	36.6	84 48.0	51.5
21	294 41.6	130 26.3	14.6	184 25.1	49.9	256 18.5	36.6	99 50.2	51.6
22	309 44.0	145 25.8	13.4	199 25.8	49.8	271 21.0	36.6	114 52.5	51.7
23	324 46.5	160 25.4	12.2	214 26.6	49.6	286 23.5	36.5	129 54.7	51.8
	h m								
Mer. Pass.	1 28.4	v −0.4	d 1.2	v 0.7	d 0.2	v 2.5	d 0.0	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.1	S40 15.1
Achernar	335 27.2	S57 10.3
Acrux	173 11.4	S63 10.0
Adhara	255 13.7	S28 59.1
Aldebaran	290 50.8	N16 32.0
Alioth	166 22.2	N55 53.9
Alkaid	153 00.1	N49 15.5
Al Na'ir	27 44.8	S46 54.1
Alnilam	275 47.7	S 1 11.6
Alphard	217 57.6	S 8 42.5
Alphecca	126 12.1	N26 40.8
Alpheratz	357 44.5	N29 09.4
Altair	62 09.2	N 8 54.2
Ankaa	353 16.5	S42 14.2
Antares	112 27.8	S26 27.5
Arcturus	145 57.0	N19 07.4
Atria	107 30.7	S69 03.1
Avior	234 19.1	S59 32.7
Bellatrix	278 33.4	N 6 21.7
Betelgeuse	271 02.8	N 7 24.6
Canopus	263 57.0	S52 41.9
Capella	280 36.4	N46 00.4
Deneb	49 32.0	N45 19.6
Denebola	182 35.2	N14 30.4
Diphda	348 56.9	S17 55.1
Dubhe	193 53.8	N61 41.3
Elnath	278 14.3	N28 36.9
Eltanin	90 46.5	N51 29.6
Enif	33 48.0	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.9
Gienah	175 53.9	S17 36.4
Hadar	148 50.1	S60 26.0
Hamal	328 02.0	N23 31.1
Kaus Aust.	83 45.3	S34 22.7
Kochab	137 20.3	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.3	N 4 08.3
Menkent	148 09.3	S36 25.8
Miaplacidus	221 40.9	S69 45.9
Mirfak	308 42.1	N49 54.0
Nunki	75 59.6	S26 16.8
Peacock	53 20.7	S56 41.8
Pollux	243 29.5	N27 59.8
Procyon	245 01.3	N 5 11.7
Rasalhague	96 07.5	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.3	S 8 11.2
Rigil Kent.	139 53.8	S60 53.2
Sabik	102 13.9	S15 44.3
Schedar	349 41.6	N56 36.1
Shaula	96 23.5	S37 06.8
Sirius	258 35.0	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.8	S43 28.7
Vega	80 39.6	N38 48.0
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	197 55.2	12 17
Mars	251 01.0	8 44
Jupiter	321 36.9	4 02
Saturn	165 19.5	14 25

2011 AUGUST 29, 30, 31 (MON., TUES., WED.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
29 00	179 42.5	N 9 33.3	183 07.7	9.2	N 5 43.0	14.1	60.4
01	194 42.7	32.4	197 35.9	9.1	5 28.9	14.2	60.4
02	209 42.9	31.5	212 04.0	9.2	5 14.7	14.2	60.4
03	224 43.0	. . 30.6	226 32.2	9.2	5 00.5	14.2	60.4
04	239 43.2	29.7	241 00.4	9.1	4 46.3	14.3	60.4
05	254 43.4	28.8	255 28.5	9.2	4 32.0	14.3	60.4
06	269 43.6	N 9 28.0	269 56.7	9.2	N 4 17.7	14.3	60.5
07	284 43.8	27.1	284 24.9	9.2	4 03.4	14.4	60.5
08	299 44.0	26.2	298 53.1	9.2	3 49.0	14.4	60.5
M 09	314 44.2	. . 25.3	313 21.3	9.2	3 34.6	14.4	60.5
O 10	329 44.3	24.4	327 49.5	9.1	3 20.2	14.4	60.5
N 11	344 44.5	23.5	342 17.6	9.2	3 05.8	14.5	60.5
D 12	359 44.7	N 9 22.6	356 45.8	9.2	N 2 51.3	14.5	60.6
A 13	14 44.9	21.7	11 14.0	9.2	2 36.8	14.5	60.6
Y 14	29 45.1	20.9	25 42.2	9.2	2 22.3	14.6	60.6
15	44 45.3	. . 20.0	40 10.4	9.2	2 07.7	14.5	60.6
16	59 45.5	19.1	54 38.6	9.1	1 53.2	14.6	60.6
17	74 45.6	18.2	69 06.7	9.2	1 38.6	14.6	60.6
18	89 45.8	N 9 17.3	83 34.9	9.1	N 1 24.0	14.6	60.6
19	104 46.0	16.4	98 03.0	9.2	1 09.4	14.6	60.6
20	119 46.2	15.5	112 31.2	9.2	0 54.8	14.6	60.7
21	134 46.4	. . 14.6	126 59.4	9.1	0 40.2	14.6	60.7
22	149 46.6	13.7	141 27.5	9.1	0 25.6	14.7	60.7
23	164 46.8	12.8	155 55.6	9.2	N 0 10.9	14.6	60.7
30 00	179 47.0	N 9 12.0	170 23.8	9.1	S 0 03.7	14.7	60.7
01	194 47.2	11.1	184 51.9	9.1	0 18.4	14.6	60.7
02	209 47.3	10.2	199 20.0	9.1	0 33.0	14.7	60.7
03	224 47.5	. . 09.3	213 48.1	9.1	0 47.7	14.6	60.7
04	239 47.7	08.4	228 16.2	9.0	1 02.3	14.6	60.7
05	254 47.9	07.5	242 44.2	9.1	1 16.9	14.7	60.7
06	269 48.1	N 9 06.6	257 12.3	9.0	S 1 31.6	14.6	60.7
07	284 48.3	05.7	271 40.3	9.1	1 46.2	14.6	60.7
T 08	299 48.5	04.8	286 08.4	9.0	2 00.8	14.6	60.7
U 09	314 48.7	. . 03.9	300 36.4	9.0	2 15.4	14.6	60.7
E 10	329 48.9	03.0	315 04.4	9.0	2 30.0	14.6	60.8
S 11	344 49.0	02.1	329 32.4	9.0	2 44.6	14.5	60.8
D 12	359 49.2	N 9 01.2	344 00.4	8.9	S 2 59.1	14.6	60.8
A 13	14 49.4	9 00.3	358 28.3	8.9	3 13.7	14.5	60.8
Y 14	29 49.6	8 59.4	12 56.2	9.0	3 28.2	14.5	60.8
15	44 49.8	. . 58.5	27 24.2	8.9	3 42.7	14.5	60.8
16	59 50.0	57.7	41 52.1	8.8	3 57.2	14.5	60.8
17	74 50.2	56.8	56 19.9	8.9	4 11.7	14.4	60.8
18	89 50.4	N 8 55.9	70 47.8	8.8	S 4 26.1	14.4	60.8
19	104 50.6	55.0	85 15.6	8.9	4 40.5	14.4	60.8
20	119 50.8	54.1	99 43.5	8.8	4 54.9	14.3	60.8
21	134 51.0	. . 53.2	114 11.3	8.7	5 09.2	14.3	60.8
22	149 51.1	52.3	128 39.0	8.8	5 23.5	14.3	60.8
23	164 51.3	51.4	143 06.8	8.7	5 37.8	14.2	60.8
31 00	179 51.5	N 8 50.5	157 34.5	8.7	S 5 52.0	14.2	60.8
01	194 51.7	49.6	172 02.2	8.7	6 06.2	14.2	60.8
02	209 51.9	48.7	186 29.9	8.6	6 20.4	14.1	60.7
03	224 52.1	. . 47.8	200 57.5	8.7	6 34.5	14.1	60.7
04	239 52.3	46.9	215 25.2	8.6	6 48.6	14.0	60.7
05	254 52.5	46.0	229 52.8	8.5	7 02.6	14.0	60.7
06	269 52.7	N 8 45.1	244 20.3	8.6	S 7 16.6	13.9	60.7
W 07	284 52.9	44.2	258 47.9	8.5	7 30.5	13.9	60.7
E 08	299 53.1	43.3	273 15.4	8.5	7 44.4	13.8	60.7
D 09	314 53.3	. . 42.4	287 42.9	8.5	7 58.2	13.8	60.7
N 10	329 53.5	41.5	302 10.4	8.4	8 12.0	13.7	60.7
E 11	344 53.7	40.6	316 37.8	8.4	8 25.7	13.7	60.7
S 12	359 53.8	N 8 39.7	331 05.2	8.4	S 8 39.4	13.6	60.7
D 13	14 54.0	38.8	345 32.6	8.3	8 53.0	13.5	60.7
A 14	29 54.2	37.9	359 59.9	8.3	9 06.5	13.5	60.7
Y 15	44 54.4	. . 37.0	14 27.2	8.3	9 20.0	13.5	60.7
16	59 54.6	36.1	28 54.5	8.2	9 33.5	13.3	60.6
17	74 54.8	35.2	43 21.7	8.2	9 46.8	13.3	60.6
18	89 55.0	N 8 34.3	57 48.9	8.2	S10 00.1	13.2	60.6
19	104 55.2	33.4	72 16.1	8.1	10 13.3	13.2	60.6
20	119 55.4	32.5	86 43.2	8.2	10 26.5	13.1	60.6
21	134 55.6	. . 31.6	101 10.4	8.0	10 39.6	13.0	60.6
22	149 55.8	30.7	115 37.4	8.1	10 52.6	12.9	60.6
23	164 56.0	29.8	130 04.5	8.0	S11 05.5	12.9	60.6
	SD 15.9	d 0.9	SD 16.5		16.6		16.5

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 29	Moonrise 30	Moonrise 31	Moonrise 1
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	02 13	03 49	05 04	07 19	09 37	12 09
N 70	////	02 46	04 05	05 11	07 16	09 24	11 39
68	01 04	03 09	04 17	05 16	07 14	09 13	11 17
66	01 54	03 27	04 27	05 20	07 12	09 05	11 00
64	02 24	03 41	04 36	05 24	07 10	08 57	10 46
62	02 46	03 53	04 43	05 27	07 09	08 51	10 34
60	03 03	04 03	04 49	05 30	07 07	08 46	10 24
N 58	03 17	04 12	04 55	05 32	07 06	08 41	10 16
56	03 29	04 20	04 59	05 34	07 05	08 37	10 08
54	03 39	04 26	05 04	05 36	07 04	08 33	10 02
52	03 48	04 32	05 08	05 38	07 04	08 30	09 56
50	03 56	04 37	05 11	05 40	07 03	08 27	09 50
45	04 12	04 48	05 19	05 43	07 01	08 20	09 39
N 40	04 24	04 57	05 25	05 46	07 00	08 15	09 29
35	04 34	05 05	05 31	05 48	06 59	08 10	09 21
30	04 42	05 11	05 36	05 51	06 58	08 06	09 14
20	04 55	05 21	05 44	05 54	06 56	07 59	09 02
N 10	05 05	05 30	05 51	05 58	06 55	07 53	08 52
0	05 12	05 36	05 57	06 01	06 54	07 47	08 42
S 10	05 18	05 43	06 04	06 04	06 52	07 42	08 32
20	05 23	05 48	06 11	06 07	06 51	07 36	08 22
30	05 26	05 54	06 18	06 11	06 50	07 29	08 10
35	05 28	05 57	06 22	06 13	06 49	07 25	08 03
40	05 29	06 00	06 27	06 16	06 48	07 21	07 56
45	05 29	06 03	06 33	06 19	06 47	07 16	07 47
S 50	05 29	06 07	06 39	06 22	06 46	07 10	07 36
52	05 29	06 08	06 43	06 24	06 45	07 07	07 32
54	05 29	06 10	06 46	06 25	06 44	07 04	07 26
56	05 29	06 12	06 50	06 27	06 44	07 01	07 20
58	05 28	06 14	06 54	06 29	06 43	06 57	07 14
S 60	05 28	06 16	06 58	06 32	06 42	06 53	07 06

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 29	Moonset 30	Moonset 31	Moonset 1
°	h m	h m	h m	h m	h m	h m	h m
N 72	20 09	21 42	////	18 40	18 19	17 55	17 19
N 70	19 54	21 11	////	18 39	18 25	18 10	17 51
68	19 42	20 49	22 46	18 38	18 31	18 23	18 14
66	19 32	20 31	22 01	18 37	18 35	18 34	18 33
64	19 24	20 17	21 33	18 36	18 39	18 42	18 48
62	19 17	20 06	21 12	18 35	18 42	18 50	19 00
60	19 11	19 56	20 56	18 34	18 45	18 57	19 11
N 58	19 05	19 48	20 42	18 34	18 47	19 03	19 21
56	19 01	19 40	20 30	18 33	18 50	19 08	19 29
54	18 56	19 34	20 21	18 33	18 52	19 12	19 36
52	18 53	19 28	20 12	18 32	18 54	19 17	19 43
50	18 49	19 23	20 04	18 32	18 55	19 21	19 49
45	18 42	19 12	19 49	18 31	18 59	19 29	20 02
N 40	18 35	19 03	19 36	18 30	19 02	19 36	20 13
35	18 30	18 56	19 27	18 29	19 05	19 42	20 22
30	18 25	18 50	19 19	18 29	19 08	19 48	20 30
20	18 17	18 40	19 06	18 28	19 12	19 57	20 44
N 10	18 10	18 32	18 57	18 27	19 15	20 05	20 57
0	18 04	18 25	18 49	18 26	19 19	20 13	21 08
S 10	17 58	18 19	18 44	18 25	19 22	20 21	21 20
20	17 51	18 13	18 39	18 24	19 26	20 29	21 32
30	17 44	18 08	18 36	18 23	19 30	20 38	21 47
35	17 40	18 05	18 34	18 22	19 33	20 44	21 55
40	17 35	18 02	18 34	18 21	19 36	20 50	22 05
45	17 29	17 59	18 33	18 20	19 39	20 58	22 16
S 50	17 23	17 55	18 33	18 19	19 43	21 06	22 29
52	17 20	17 54	18 33	18 18	19 44	21 11	22 36
54	17 16	17 52	18 33	18 18	19 46	21 15	22 43
56	17 13	17 51	18 34	18 17	19 48	21 20	22 51
58	17 09	17 49	18 34	18 16	19 51	21 26	23 00
S 60	17 04	17 47	18 35	18 16	19 54	21 32	23 10

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
29	01 10	01 02	12 01	12 13	24 40	00	0
30	00 53	00 43	12 01	13 06	00 40	01	3
31	00 34	00 25	12 00	14 00	01 33	02	8

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.7		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1 00	339 48.9	175 25.0	N 8 11.1	229 27.3	N22 49.4	301 26.0	N13 36.5	144 56.9	S 3 51.9
01	354 51.4	190 24.5	09.9	244 28.1	49.2	316 28.4	36.5	159 59.1	52.0
02	9 53.9	205 24.1	08.7	259 28.8	49.0	331 30.9	36.5	175 01.4	52.1
03	24 56.3	220 23.7	. . 07.5	274 29.6	. . 48.8	346 33.4	. . 36.5	190 03.6	. . 52.2
04	39 58.8	235 23.3	06.3	289 30.3	48.6	1 35.9	36.5	205 05.8	52.3
05	55 01.3	250 22.8	05.1	304 31.1	48.4	16 38.3	36.5	220 08.0	52.4
06	70 03.7	265 22.4	N 8 03.9	319 31.8	N22 48.3	31 40.8	N13 36.5	235 10.2	S 3 52.5
07	85 06.2	280 22.0	02.7	334 32.6	48.1	46 43.3	36.4	250 12.5	52.7
T 08	100 08.7	295 21.6	01.5	349 33.3	47.9	61 45.8	36.4	265 14.7	52.8
H 09	115 11.1	310 21.1	8 00.3	4 34.1	. . 47.7	76 48.2	. . 36.4	280 16.9	. . 52.9
U 10	130 13.6	325 20.7	7 59.2	19 34.8	47.5	91 50.7	36.4	295 19.1	53.0
R 11	145 16.0	340 20.3	58.0	34 35.6	47.3	106 53.2	36.4	310 21.3	53.1
S 12	160 18.5	355 19.8	N 7 56.8	49 36.3	N22 47.1	121 55.7	N13 36.4	325 23.6	S 3 53.2
D 13	175 21.0	10 19.4	55.6	64 37.1	46.9	136 58.2	36.4	340 25.8	53.3
A 14	190 23.4	25 19.0	54.4	79 37.8	46.7	152 00.6	36.3	355 28.0	53.4
Y 15	205 25.9	40 18.6	. . 53.2	94 38.6	. . 46.6	167 03.1	. . 36.3	10 30.2	. . 53.5
16	220 28.4	55 18.2	52.0	109 39.3	46.4	182 05.6	36.3	25 32.4	53.6
17	235 30.8	70 17.7	50.8	124 40.1	46.2	197 08.1	36.3	40 34.7	53.7
18	250 33.3	85 17.3	N 7 49.6	139 40.8	N22 46.0	212 10.6	N13 36.3	55 36.9	S 3 53.8
19	265 35.8	100 16.9	48.4	154 41.6	45.8	227 13.0	36.3	70 39.1	53.9
20	280 38.2	115 16.5	47.2	169 42.3	45.6	242 15.5	36.3	85 41.3	54.0
21	295 40.7	130 16.0	. . 46.0	184 43.1	. . 45.4	257 18.0	. . 36.2	100 43.5	. . 54.1
22	310 43.2	145 15.6	44.8	199 43.8	45.2	272 20.5	36.2	115 45.8	54.3
23	325 45.6	160 15.2	43.6	214 44.6	45.0	287 23.0	36.2	130 48.0	54.4
2 00	340 48.1	175 14.8	N 7 42.4	229 45.4	N22 44.8	302 25.4	N13 36.2	145 50.2	S 3 54.5
01	355 50.5	190 14.4	41.2	244 46.1	44.6	317 27.9	36.2	160 52.4	54.6
02	10 53.0	205 13.9	40.0	259 46.9	44.4	332 30.4	36.2	175 54.6	54.7
03	25 55.5	220 13.5	. . 38.8	274 47.6	. . 44.2	347 32.9	. . 36.2	190 56.9	. . 54.8
04	40 57.9	235 13.1	37.6	289 48.4	44.0	2 35.4	36.1	205 59.1	54.9
05	56 00.4	250 12.7	36.4	304 49.1	43.9	17 37.9	36.1	221 01.3	55.0
06	71 02.9	265 12.2	N 7 35.2	319 49.9	N22 43.7	32 40.3	N13 36.1	236 03.5	S 3 55.1
07	86 05.3	280 11.8	34.0	334 50.6	43.5	47 42.8	36.1	251 05.7	55.2
08	101 07.8	295 11.4	32.8	349 51.4	43.3	62 45.3	36.1	266 08.0	55.3
F 09	116 10.3	310 11.0	. . 31.6	4 52.1	. . 43.1	77 47.8	. . 36.1	281 10.2	. . 55.4
R 10	131 12.7	325 10.6	30.4	19 52.9	42.9	92 50.3	36.0	296 12.4	55.5
I 11	146 15.2	340 10.2	29.2	34 53.7	42.7	107 52.8	36.0	311 14.6	55.6
D 12	161 17.6	355 09.7	N 7 28.0	49 54.4	N22 42.5	122 55.3	N13 36.0	326 16.8	S 3 55.8
A 13	176 20.1	10 09.3	26.8	64 55.2	42.3	137 57.7	36.0	341 19.1	55.9
Y 14	191 22.6	25 08.9	25.6	79 55.9	42.1	153 00.2	36.0	356 21.3	56.0
15	206 25.0	40 08.5	. . 24.4	94 56.7	. . 41.9	168 02.7	. . 36.0	11 23.5	. . 56.1
16	221 27.5	55 08.1	23.2	109 57.4	41.7	183 05.2	35.9	26 25.7	56.2
17	236 30.0	70 07.6	22.0	124 58.2	41.5	198 07.7	35.9	41 27.9	56.3
18	251 32.4	85 07.2	N 7 20.8	139 59.0	N22 41.3	213 10.2	N13 35.9	56 30.2	S 3 56.4
19	266 34.9	100 06.8	19.6	154 59.7	41.1	228 12.7	35.9	71 32.4	56.5
20	281 37.4	115 06.4	18.4	170 00.5	40.9	243 15.2	35.9	86 34.6	56.6
21	296 39.8	130 06.0	. . 17.2	185 01.2	. . 40.7	258 17.7	. . 35.9	101 36.8	. . 56.7
22	311 42.3	145 05.6	16.0	200 02.0	40.5	273 20.1	35.8	116 39.0	56.8
23	326 44.8	160 05.1	14.8	215 02.8	40.3	288 22.6	35.8	131 41.2	56.9
3 00	341 47.2	175 04.7	N 7 13.6	230 03.5	N22 40.1	303 25.1	N13 35.8	146 43.5	S 3 57.0
01	356 49.7	190 04.3	12.4	245 04.3	39.9	318 27.6	35.8	161 45.7	57.1
02	11 52.1	205 03.9	11.2	260 05.0	39.7	333 30.1	35.8	176 47.9	57.3
03	26 54.6	220 03.5	. . 10.0	275 05.8	. . 39.5	348 32.6	. . 35.8	191 50.1	. . 57.4
04	41 57.1	235 03.1	08.8	290 06.6	39.3	3 35.1	35.7	206 52.3	57.5
05	56 59.5	250 02.7	07.6	305 07.3	39.1	18 37.6	35.7	221 54.6	57.6
06	72 02.0	265 02.2	N 7 06.3	320 08.1	N22 38.9	33 40.1	N13 35.7	236 56.8	S 3 57.7
07	87 04.5	280 01.8	05.1	335 08.8	38.7	48 42.6	35.7	251 59.0	57.8
S 08	102 06.9	295 01.4	03.9	350 09.6	38.5	63 45.1	35.7	267 01.2	57.9
A 09	117 09.4	310 01.0	. . 02.7	5 10.4	. . 38.3	78 47.6	. . 35.6	282 03.4	. . 58.0
T 10	132 11.9	325 00.6	01.5	20 11.1	38.1	93 50.1	35.6	297 05.6	58.1
U 11	147 14.3	340 00.2	7 00.3	35 11.9	37.9	108 52.5	35.6	312 07.9	58.2
R 12	162 16.8	354 59.8	N 6 59.1	50 12.6	N22 37.7	123 55.0	N13 35.6	327 10.1	S 3 58.3
D 13	177 19.3	9 59.4	57.9	65 13.4	37.5	138 57.5	35.6	342 12.3	58.4
A 14	192 21.7	24 58.9	56.7	80 14.2	37.3	154 00.0	35.6	357 14.5	58.5
Y 15	207 24.2	39 58.5	. . 55.5	95 14.9	. . 37.1	169 02.5	. . 35.5	12 16.7	. . 58.7
16	222 26.6	54 58.1	54.2	110 15.7	36.9	184 05.0	35.5	27 18.9	58.8
17	237 29.1	69 57.7	53.0	125 16.5	36.7	199 07.5	35.5	42 21.2	58.9
18	252 31.6	84 57.3	N 6 51.8	140 17.2	N22 36.5	214 10.0	N13 35.5	57 23.4	S 3 59.0
19	267 34.0	99 56.9	50.6	155 18.0	36.3	229 12.5	35.5	72 25.6	59.1
20	282 36.5	114 56.5	49.4	170 18.8	36.1	244 15.0	35.4	87 27.8	59.2
21	297 39.0	129 56.1	. . 48.2	185 19.5	. . 35.8	259 17.5	. . 35.4	102 30.0	. . 59.3
22	312 41.4	144 55.7	47.0	200 20.3	35.6	274 20.0	35.4	117 32.2	59.4
23	327 43.9	159 55.3	45.8	215 21.0	35.4	289 22.5	35.4	132 34.5	59.5
	h m								
Mer. Pass.	1 16.6	*v* −0.4	*d* 1.2	*v* 0.8	*d* 0.2	*v* 2.5	*d* 0.0	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.1	S40 15.2
Achernar	335 27.2	S57 10.3
Acrux	173 11.4	S63 10.0
Adhara	255 13.7	S28 59.1
Aldebaran	290 50.8	N16 32.0
Alioth	166 22.2	N55 53.9
Alkaid	153 00.1	N49 15.5
Al Na'ir	27 44.8	S46 54.1
Alnilam	275 47.7	S 1 11.6
Alphard	217 57.6	S 8 42.5
Alphecca	126 12.1	N26 40.8
Alpheratz	357 44.5	N29 09.5
Altair	62 09.2	N 8 54.2
Ankaa	353 16.5	S42 14.3
Antares	112 27.8	S26 27.5
Arcturus	145 57.0	N19 07.4
Atria	107 30.7	S69 03.1
Avior	234 19.1	S59 32.7
Bellatrix	278 33.4	N 6 21.7
Betelgeuse	271 02.8	N 7 24.6
Canopus	263 57.0	S52 41.9
Capella	280 36.4	N46 00.4
Deneb	49 32.0	N45 19.6
Denebola	182 35.2	N14 30.4
Diphda	348 56.8	S17 55.1
Dubhe	193 53.8	N61 41.3
Elnath	278 14.3	N28 36.9
Eltanin	90 46.5	N51 29.6
Enif	33 48.0	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.9
Gienah	175 53.9	S17 36.4
Hadar	148 50.1	S60 26.0
Hamal	328 02.0	N23 31.1
Kaus Aust.	83 45.3	S34 22.7
Kochab	137 20.3	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.2	N 4 08.3
Menkent	148 09.3	S36 25.7
Miaplacidus	221 40.9	S69 45.9
Mirfak	308 42.0	N49 54.0
Nunki	75 59.7	S26 16.8
Peacock	53 20.7	S56 41.8
Pollux	243 29.5	N27 59.8
Procyon	245 01.3	N 5 11.7
Rasalhague	96 07.5	N12 33.3
Regulus	207 45.2	N11 54.6
Rigel	281 13.3	S 8 11.2
Rigil Kent.	139 53.8	S60 53.2
Sabik	102 13.9	S15 44.3
Schedar	349 41.5	N56 36.1
Shaula	96 23.5	S37 06.8
Sirius	258 35.0	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.8	S43 28.7
Vega	80 39.6	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	194 26.7	12 19
Mars	248 57.3	8 41
Jupiter	321 37.4	3 50
Saturn	165 02.1	14 15

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
1 00	179 56.2	N 8 28.9	144 31.5	8.0	S11 18.4	12.8	60.6
01	194 56.4	28.0	158 58.5	7.9	11 31.2	12.7	60.5
02	209 56.6	27.1	173 25.4	7.9	11 43.9	12.6	60.5
03	224 56.8	26.2	187 52.3	7.9	11 56.5	12.5	60.5
04	239 57.0	25.3	202 19.2	7.8	12 09.0	12.5	60.5
05	254 57.2	24.3	216 46.0	7.8	12 21.5	12.4	60.5
06	269 57.4	N 8 23.4	231 12.8	7.7	S12 33.9	12.3	60.5
07	284 57.6	22.5	245 39.5	7.8	12 46.2	12.2	60.5
T 08	299 57.8	21.6	260 06.3	7.6	12 58.4	12.1	60.4
H 09	314 57.9	20.7	274 32.9	7.7	13 10.5	12.0	60.4
U 10	329 58.1	19.8	288 59.6	7.6	13 22.5	11.9	60.4
R 11	344 58.3	18.9	303 26.2	7.6	13 34.4	11.9	60.4
S 12	359 58.5	N 8 18.0	317 52.8	7.5	S13 46.3	11.7	60.4
D 13	14 58.7	17.1	332 19.3	7.5	13 58.0	11.7	60.3
A 14	29 58.9	16.2	346 45.8	7.5	14 09.7	11.5	60.3
Y 15	44 59.1	15.3	1 12.3	7.4	14 21.2	11.5	60.3
16	59 59.3	14.4	15 38.7	7.4	14 32.7	11.3	60.3
17	74 59.5	13.5	30 05.1	7.3	14 44.0	11.3	60.3
18	89 59.7	N 8 12.6	44 31.4	7.4	S14 55.3	11.1	60.3
19	104 59.9	11.7	58 57.8	7.2	15 06.4	11.0	60.2
20	120 00.1	10.8	73 24.0	7.3	15 17.4	11.0	60.2
21	135 00.3	09.8	87 50.3	7.2	15 28.4	10.8	60.2
22	150 00.5	08.9	102 16.5	7.2	15 39.2	10.7	60.2
23	165 00.7	08.0	116 42.7	7.1	15 49.9	10.6	60.2
2 00	180 00.9	N 8 07.1	131 08.8	7.1	S16 00.5	10.5	60.1
01	195 01.1	06.2	145 34.9	7.1	16 11.0	10.4	60.1
02	210 01.3	05.3	160 01.0	7.0	16 21.4	10.3	60.1
03	225 01.5	04.4	174 27.0	7.0	16 31.7	10.2	60.1
04	240 01.7	03.5	188 53.0	6.9	16 41.9	10.0	60.0
05	255 01.9	02.6	203 18.9	7.0	16 51.9	9.9	60.0
06	270 02.1	N 8 01.7	217 44.9	6.9	S17 01.8	9.9	60.0
07	285 02.3	8 00.8	232 10.8	6.8	17 11.7	9.7	60.0
F 08	300 02.5	7 59.8	246 36.6	6.8	17 21.4	9.5	60.0
R 09	315 02.7	58.9	261 02.4	6.8	17 30.9	9.5	59.9
I 10	330 02.9	58.0	275 28.2	6.8	17 40.4	9.3	59.9
D 11	345 03.1	57.1	289 54.0	6.7	17 49.7	9.2	59.9
A 12	0 03.3	N 7 56.2	304 19.7	6.7	S17 58.9	9.1	59.9
Y 13	15 03.5	55.3	318 45.4	6.7	18 08.0	9.0	59.8
14	30 03.7	54.4	333 11.1	6.6	18 17.0	8.8	59.8
15	45 03.9	53.5	347 36.7	6.6	18 25.8	8.7	59.8
16	60 04.1	52.5	2 02.3	6.6	18 34.5	8.6	59.8
17	75 04.3	51.6	16 27.9	6.5	18 43.1	8.5	59.7
18	90 04.5	N 7 50.7	30 53.4	6.5	S18 51.6	8.3	59.7
19	105 04.7	49.8	45 18.9	6.5	18 59.9	8.2	59.7
20	120 04.9	48.9	59 44.4	6.5	19 08.1	8.1	59.7
21	135 05.1	48.0	74 09.9	6.4	19 16.2	7.9	59.6
22	150 05.3	47.1	88 35.3	6.5	19 24.1	7.8	59.6
23	165 05.5	46.2	103 00.8	6.4	19 31.9	7.7	59.6
3 00	180 05.7	N 7 45.2	117 26.2	6.3	S19 39.6	7.5	59.5
01	195 05.9	44.3	131 51.5	6.4	19 47.1	7.4	59.5
02	210 06.1	43.4	146 16.9	6.3	19 54.5	7.3	59.5
03	225 06.3	42.5	160 42.2	6.3	20 01.8	7.1	59.5
04	240 06.5	41.6	175 07.5	6.3	20 08.9	7.0	59.4
05	255 06.7	40.7	189 32.8	6.2	20 15.9	6.8	59.4
06	270 06.9	N 7 39.8	203 58.0	6.3	S20 22.7	6.8	59.4
07	285 07.1	38.8	218 23.3	6.2	20 29.5	6.5	59.4
S 08	300 07.3	37.9	232 48.5	6.2	20 36.0	6.5	59.3
A 09	315 07.5	37.0	247 13.7	6.2	20 42.5	6.3	59.3
T 10	330 07.7	36.1	261 38.9	6.2	20 48.8	6.1	59.3
U 11	345 07.9	35.2	276 04.1	6.2	20 54.9	6.0	59.2
R 12	0 08.2	N 7 34.3	290 29.3	6.1	S21 00.9	5.9	59.2
D 13	15 08.4	33.3	304 54.4	6.1	21 06.8	5.7	59.2
A 14	30 08.6	32.4	319 19.5	6.2	21 12.5	5.6	59.2
Y 15	45 08.8	31.5	333 44.7	6.1	21 18.1	5.5	59.1
16	60 09.0	30.6	348 09.8	6.1	21 23.6	5.3	59.1
17	75 09.2	29.7	2 34.9	6.1	21 28.9	5.1	59.1
18	90 09.4	N 7 28.8	17 00.0	6.1	S21 34.0	5.0	59.0
19	105 09.6	27.8	31 25.1	6.1	21 39.0	4.9	59.0
20	120 09.8	26.9	45 50.2	6.1	21 43.9	4.7	59.0
21	135 10.0	26.0	60 15.3	6.1	21 48.6	4.6	59.0
22	150 10.2	25.1	74 40.4	6.1	21 53.2	4.5	58.9
23	165 10.4	24.2	89 05.5	6.1	S21 57.7	4.2	58.9
	SD 15.9	d 0.9	SD 16.4		16.3		16.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 1	Moonrise 2	Moonrise 3	Moonrise 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	02 35	04 04	12 09			
N 70	////	03 03	04 18	11 39	14 14		
68	01 36	03 23	04 28	11 17	13 27	15 58	
66	02 13	03 39	04 37	11 00	12 57	14 52	16 34
64	02 38	03 52	04 44	10 46	12 34	14 17	15 44
62	02 58	04 02	04 51	10 34	12 16	13 52	15 13
60	03 13	04 11	04 56	10 24	12 01	13 32	14 49
N 58	03 26	04 19	05 01	10 16	11 49	13 15	14 30
56	03 37	04 26	05 05	10 08	11 38	13 02	14 15
54	03 46	04 32	05 09	10 02	11 28	12 50	14 01
52	03 54	04 37	05 13	09 56	11 20	12 39	13 49
50	04 01	04 42	05 16	09 50	11 12	12 30	13 39
45	04 16	04 52	05 23	09 39	10 56	12 10	13 17
N 40	04 27	05 00	05 28	09 29	10 43	11 54	12 59
35	04 37	05 07	05 33	09 21	10 32	11 40	12 45
30	04 44	05 13	05 37	09 14	10 22	11 29	12 32
20	04 56	05 22	05 45	09 02	10 06	11 09	12 10
N 10	05 05	05 30	05 51	08 52	09 51	10 52	11 51
0	05 11	05 36	05 57	08 42	09 38	10 35	11 33
S 10	05 16	05 41	06 02	08 32	09 25	10 19	11 16
20	05 20	05 46	06 08	08 22	09 11	10 02	10 57
30	05 23	05 51	06 15	08 10	08 54	09 43	10 36
35	05 24	05 53	06 18	08 03	08 45	09 32	10 23
40	05 24	05 55	06 23	07 56	08 35	09 19	10 09
45	05 24	05 58	06 27	07 47	08 22	09 03	09 51
S 50	05 23	06 01	06 33	07 36	08 07	08 45	09 30
52	05 23	06 02	06 36	07 32	08 00	08 36	09 20
54	05 22	06 03	06 39	07 26	07 53	08 26	09 09
56	05 22	06 05	06 42	07 20	07 44	08 15	08 56
58	05 21	06 06	06 45	07 14	07 35	08 02	08 41
S 60	05 19	06 07	06 49	07 06	07 24	07 48	08 23

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 1	Moonset 2	Moonset 3	Moonset 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	19 52	21 18	////	17 19			
N 70	19 39	20 53	23 24	17 51	17 14		
68	19 29	20 33	22 15	18 14	18 02	17 32	
66	19 20	20 18	21 41	18 33	18 34	18 38	18 58
64	19 13	20 06	21 17	18 48	18 57	19 14	19 48
62	19 07	19 55	20 59	19 00	19 16	19 40	20 20
60	19 02	19 46	20 44	19 11	19 31	20 00	20 43
N 58	18 57	19 39	20 32	19 21	19 44	20 17	21 02
56	18 53	19 32	20 21	19 29	19 56	20 31	21 18
54	18 49	19 26	20 12	19 36	20 06	20 44	21 32
52	18 46	19 21	20 04	19 43	20 15	20 54	21 44
50	18 43	19 16	19 57	19 49	20 23	21 04	21 54
45	18 36	19 06	19 43	20 02	20 40	21 24	22 16
N 40	18 31	18 58	19 31	20 13	20 54	21 41	22 34
35	18 26	18 52	19 22	20 22	21 06	21 55	22 49
30	18 22	18 46	19 15	20 30	21 17	22 07	23 02
20	18 15	18 37	19 03	20 44	21 35	22 28	23 24
N 10	18 09	18 30	18 55	20 57	21 50	22 46	23 43
0	18 03	18 24	18 48	21 08	22 05	23 03	24 01
S 10	17 58	18 19	18 43	21 20	22 20	23 20	24 19
20	17 52	18 14	18 40	21 32	22 36	23 38	24 38
30	17 45	18 09	18 37	21 47	22 54	23 59	25 00
35	17 42	18 07	18 36	21 55	23 05	24 11	00 11
40	17 38	18 05	18 36	22 05	23 17	24 26	00 26
45	17 33	18 02	18 36	22 16	23 32	24 42	00 42
S 50	17 27	18 00	18 37	22 29	23 49	25 03	01 03
52	17 25	17 59	18 38	22 36	23 58	25 13	01 13
54	17 22	17 57	18 38	22 43	24 07	00 07	01 24
56	17 19	17 56	18 39	22 51	24 18	00 18	01 37
58	17 15	17 55	18 40	23 00	24 30	00 30	01 51
S 60	17 11	17 53	18 42	23 10	24 44	00 44	02 09

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
1	00 16	00 06	12 00	14 55	02 27	03	16
2	00 03	00 13	12 00	15 52	03 23	04	26
3	00 22	00 32	11 59	16 49	04 20	05	36

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.7		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
4 00	342 46.4	174 54.8	N 6 44.5	230 21.8	N22 35.2	304 25.0	N13 35.4	147 36.7	S 3 59.6
01	357 48.8	189 54.4	43.3	245 22.6	35.0	319 27.5	35.3	162 38.9	59.7
02	12 51.3	204 54.0	42.1	260 23.3	34.8	334 30.0	35.3	177 41.1	59.8
03	27 53.8	219 53.6	40.9	275 24.1	34.6	349 32.5	35.3	192 43.3	3 59.9
04	42 56.2	234 53.2	39.7	290 24.9	34.4	4 35.0	35.3	207 45.5	4 00.1
05	57 58.7	249 52.8	38.5	305 25.6	34.2	19 37.5	35.3	222 47.8	00.2
06	73 01.1	264 52.4	N 6 37.3	320 26.4	N22 34.0	34 40.0	N13 35.2	237 50.0	S 4 00.3
07	88 03.6	279 52.0	36.0	335 27.2	33.8	49 42.5	35.2	252 52.2	00.4
08	103 06.1	294 51.6	34.8	350 27.9	33.6	64 45.0	35.2	267 54.4	00.5
S 09	118 08.5	309 51.2	33.6	5 28.7	33.4	79 47.5	35.2	282 56.6	00.6
U 10	133 11.0	324 50.8	32.4	20 29.5	33.2	94 50.0	35.2	297 58.8	00.7
N 11	148 13.5	339 50.4	31.2	35 30.2	32.9	109 52.5	35.1	313 01.1	00.8
D 12	163 15.9	354 50.0	N 6 30.0	50 31.0	N22 32.7	124 55.0	N13 35.1	328 03.3	S 4 00.9
A 13	178 18.4	9 49.5	28.7	65 31.8	32.5	139 57.5	35.1	343 05.5	01.0
Y 14	193 20.9	24 49.1	27.5	80 32.5	32.3	155 00.0	35.1	358 07.7	01.1
15	208 23.3	39 48.7	26.3	95 33.3	32.1	170 02.5	35.0	13 09.9	01.2
16	223 25.8	54 48.3	25.1	110 34.1	31.9	185 05.0	35.0	28 12.1	01.4
17	238 28.2	69 47.9	23.9	125 34.9	31.7	200 07.5	35.0	43 14.3	01.5
18	253 30.7	84 47.5	N 6 22.6	140 35.6	N22 31.5	215 10.0	N13 35.0	58 16.6	S 4 01.6
19	268 33.2	99 47.1	21.4	155 36.4	31.3	230 12.5	35.0	73 18.8	01.7
20	283 35.6	114 46.7	20.2	170 37.2	31.1	245 15.1	34.9	88 21.0	01.8
21	298 38.1	129 46.3	19.0	185 37.9	30.8	260 17.6	34.9	103 23.2	01.9
22	313 40.6	144 45.9	17.8	200 38.7	30.6	275 20.1	34.9	118 25.4	02.0
23	328 43.0	159 45.5	16.5	215 39.5	30.4	290 22.6	34.9	133 27.6	02.1
5 00	343 45.5	174 45.1	N 6 15.3	230 40.2	N22 30.2	305 25.1	N13 34.8	148 29.9	S 4 02.2
01	358 48.0	189 44.7	14.1	245 41.0	30.0	320 27.6	34.8	163 32.1	02.3
02	13 50.4	204 44.3	12.9	260 41.8	29.8	335 30.1	34.8	178 34.3	02.4
03	28 52.9	219 43.9	11.7	275 42.6	29.6	350 32.6	34.8	193 36.5	02.5
04	43 55.4	234 43.5	10.4	290 43.3	29.4	5 35.1	34.8	208 38.7	02.7
05	58 57.8	249 43.1	09.2	305 44.1	29.1	20 37.6	34.7	223 40.9	02.8
06	74 00.3	264 42.7	N 6 08.0	320 44.9	N22 28.9	35 40.1	N13 34.7	238 43.1	S 4 02.9
07	89 02.7	279 42.3	06.8	335 45.6	28.7	50 42.6	34.7	253 45.4	03.0
08	104 05.2	294 41.9	05.5	350 46.4	28.5	65 45.1	34.7	268 47.6	03.1
M 09	119 07.7	309 41.5	04.3	5 47.2	28.3	80 47.7	34.6	283 49.8	03.2
O 10	134 10.1	324 41.1	03.1	20 48.0	28.1	95 50.2	34.6	298 52.0	03.3
N 11	149 12.6	339 40.7	01.9	35 48.7	27.9	110 52.7	34.6	313 54.2	03.4
D 12	164 15.1	354 40.3	N 6 00.6	50 49.5	N22 27.6	125 55.2	N13 34.6	328 56.4	S 4 03.5
A 13	179 17.5	9 39.9	S 5 59.4	65 50.3	27.4	140 57.7	34.5	343 58.6	03.6
Y 14	194 20.0	24 39.5	58.2	80 51.0	27.2	156 00.2	34.5	359 00.9	03.7
15	209 22.5	39 39.1	57.0	95 51.8	27.0	171 02.7	34.5	14 03.1	03.8
16	224 24.9	54 38.7	55.7	110 52.6	26.8	186 05.2	34.5	29 05.3	04.0
17	239 27.4	69 38.3	54.5	125 53.4	26.6	201 07.8	34.4	44 07.5	04.1
18	254 29.9	84 37.9	N 5 53.3	140 54.1	N22 26.3	216 10.3	N13 34.4	59 09.7	S 4 04.2
19	269 32.3	99 37.5	52.1	155 54.9	26.1	231 12.8	34.4	74 11.9	04.3
20	284 34.8	114 37.1	50.8	170 55.7	25.9	246 15.3	34.4	89 14.1	04.4
21	299 37.2	129 36.7	49.6	185 56.5	25.7	261 17.8	34.3	104 16.3	04.5
22	314 39.7	144 36.3	48.4	200 57.2	25.5	276 20.3	34.3	119 18.6	04.6
23	329 42.2	159 35.9	47.1	215 58.0	25.2	291 22.8	34.3	134 20.8	04.7
6 00	344 44.6	174 35.5	N 5 45.9	230 58.8	N22 25.0	306 25.4	N13 34.3	149 23.0	S 4 04.8
01	359 47.1	189 35.1	44.7	245 59.6	24.8	321 27.9	34.2	164 25.2	04.9
02	14 49.6	204 34.7	43.5	261 00.4	24.6	336 30.4	34.2	179 27.4	05.0
03	29 52.0	219 34.3	42.2	276 01.1	24.4	351 32.9	34.2	194 29.6	05.2
04	44 54.5	234 33.9	41.0	291 01.9	24.2	6 35.4	34.2	209 31.8	05.3
05	59 57.0	249 33.5	39.8	306 02.7	23.9	21 37.9	34.1	224 34.0	05.4
06	74 59.4	264 33.1	N 5 38.5	321 03.5	N22 23.7	36 40.4	N13 34.1	239 36.3	S 4 05.5
07	90 01.9	279 32.7	37.3	336 04.2	23.5	51 43.0	34.1	254 38.5	05.6
T 08	105 04.4	294 32.3	36.1	351 05.0	23.3	66 45.5	34.1	269 40.7	05.7
U 09	120 06.8	309 31.9	34.8	6 05.8	23.0	81 48.0	34.0	284 42.9	05.8
E 10	135 09.3	324 31.5	33.6	21 06.6	22.8	96 50.5	34.0	299 45.1	05.9
S 11	150 11.7	339 31.1	32.4	36 07.4	22.6	111 53.0	34.0	314 47.3	06.0
D 12	165 14.2	354 30.7	N 5 31.2	51 08.1	N22 22.4	126 55.6	N13 34.0	329 49.5	S 4 06.1
A 13	180 16.7	9 30.3	29.9	66 08.9	22.2	141 58.1	33.9	344 51.7	06.2
Y 14	195 19.1	24 29.9	28.7	81 09.7	21.9	157 00.6	33.9	359 54.0	06.4
15	210 21.6	39 29.5	27.5	96 10.5	21.7	172 03.1	33.9	14 56.2	06.5
16	225 24.1	54 29.1	26.2	111 11.2	21.5	187 05.6	33.9	29 58.4	06.6
17	240 26.5	69 28.7	25.0	126 12.0	21.3	202 08.2	33.8	45 00.6	06.7
18	255 29.0	84 28.3	N 5 23.8	141 12.8	N22 21.1	217 10.7	N13 33.8	60 02.8	S 4 06.8
19	270 31.5	99 28.0	22.5	156 13.6	20.8	232 13.2	33.8	75 05.0	06.9
20	285 33.9	114 27.6	21.3	171 14.4	20.6	247 15.7	33.7	90 07.2	07.0
21	300 36.4	129 27.2	20.1	186 15.2	20.4	262 18.2	33.7	105 09.4	07.1
22	315 38.8	144 26.8	18.8	201 15.9	20.2	277 20.8	33.7	120 11.7	07.2
23	330 41.3	159 26.4	17.6	216 16.7	19.9	292 23.3	33.7	135 13.9	07.3
	h m								
Mer. Pass.	1 04.8	*v* −0.4	*d* 1.2	*v* 0.8	*d* 0.2	*v* 2.5	*d* 0.0	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.1	S40 15.2
Achernar	335 27.2	S57 10.3
Acrux	173 11.4	S63 10.0
Adhara	255 13.7	S28 59.1
Aldebaran	290 50.8	N16 32.0
Alioth	166 22.2	N55 53.9
Alkaid	153 00.2	N49 15.5
Al Na'ir	27 44.8	S46 54.1
Alnilam	275 47.7	S 1 11.6
Alphard	217 57.6	S 8 42.5
Alphecca	126 12.2	N26 40.8
Alpheratz	357 44.5	N29 09.5
Altair	62 09.2	N 8 54.2
Ankaa	353 16.5	S42 14.3
Antares	112 27.8	S26 27.5
Arcturus	145 57.1	N19 07.4
Atria	107 30.8	S69 03.1
Avior	234 19.1	S59 32.7
Bellatrix	278 33.4	N 6 21.7
Betelgeuse	271 02.7	N 7 24.6
Canopus	263 56.9	S52 41.9
Capella	280 36.4	N46 00.4
Deneb	49 32.0	N45 19.6
Denebola	182 35.2	N14 30.4
Diphda	348 56.8	S17 55.1
Dubhe	193 53.8	N61 41.2
Elnath	278 14.3	N28 36.9
Eltanin	90 46.6	N51 29.6
Enif	33 48.0	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.9
Gienah	175 53.9	S17 36.4
Hadar	148 50.1	S60 26.0
Hamal	328 02.0	N23 31.1
Kaus Aust.	83 45.3	S34 22.7
Kochab	137 20.4	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.2	N 4 08.3
Menkent	148 09.3	S36 25.7
Miaplacidus	221 40.9	S69 45.9
Mirfak	308 42.0	N49 54.0
Nunki	75 59.7	S26 16.8
Peacock	53 20.7	S56 41.8
Pollux	243 29.5	N27 59.8
Procyon	245 01.2	N 5 11.7
Rasalhague	96 07.5	N12 33.3
Regulus	207 45.1	N11 54.6
Rigel	281 13.3	S 8 11.2
Rigil Kent.	139 53.8	S60 53.2
Sabik	102 13.9	S15 44.3
Schedar	349 41.5	N56 36.1
Shaula	96 23.5	S37 06.8
Sirius	258 35.0	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.8	S43 28.7
Vega	80 39.6	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	190 59.6	12 21
Mars	246 54.7	8 37
Jupiter	321 39.6	3 38
Saturn	164 44.4	14 04

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
4 00	180 10.6	N 7 23.2	103 30.6	6.1	S22 01.9	4.2	58.9
01	195 10.8	22.3	117 55.7	6.1	22 06.1	4.0	58.8
02	210 11.0	21.4	132 20.8	6.0	22 10.1	3.8	58.8
03	225 11.2	20.5	146 45.8	6.1	22 13.9	3.8	58.8
04	240 11.4	19.6	161 10.9	6.2	22 17.7	3.5	58.8
05	255 11.6	18.6	175 36.1	6.1	22 21.2	3.4	58.7
06	270 11.8	N 7 17.7	190 01.2	6.1	S22 24.6	3.3	58.7
07	285 12.0	16.8	204 26.3	6.1	22 27.9	3.1	58.7
08	300 12.2	15.9	218 51.4	6.1	22 31.0	3.0	58.6
S 09	315 12.4	15.0	233 16.5	6.2	22 34.0	2.8	58.6
U 10	330 12.7	14.0	247 41.7	6.2	22 36.8	2.7	58.6
N 11	345 12.9	13.1	262 06.9	6.1	22 39.5	2.5	58.5
D 12	0 13.1	N 7 12.2	276 32.0	6.2	S22 42.0	2.4	58.5
A 13	15 13.3	11.3	290 57.2	6.2	22 44.4	2.3	58.5
Y 14	30 13.5	10.4	305 22.4	6.3	22 46.7	2.1	58.5
15	45 13.7	09.4	319 47.7	6.2	22 48.8	1.9	58.4
16	60 13.9	08.5	334 12.9	6.3	22 50.7	1.8	58.4
17	75 14.1	07.6	348 38.2	6.3	22 52.5	1.7	58.4
18	90 14.3	N 7 06.7	3 03.5	6.3	S22 54.2	1.5	58.3
19	105 14.5	05.7	17 28.8	6.3	22 55.7	1.3	58.3
20	120 14.7	04.8	31 54.1	6.4	22 57.0	1.3	58.3
21	135 14.9	03.9	46 19.5	6.4	22 58.3	1.0	58.3
22	150 15.1	03.0	60 44.9	6.4	22 59.3	1.0	58.2
23	165 15.3	02.1	75 10.3	6.5	23 00.3	0.8	58.2
5 00	180 15.6	N 7 01.1	89 35.8	6.4	S23 01.1	0.6	58.2
01	195 15.8	7 00.2	104 01.2	6.6	23 01.7	0.5	58.1
02	210 16.0	6 59.3	118 26.8	6.5	23 02.2	0.4	58.1
03	225 16.2	58.4	132 52.3	6.6	23 02.6	0.2	58.1
04	240 16.4	57.4	147 17.9	6.6	23 02.8	0.0	58.0
05	255 16.6	56.5	161 43.5	6.7	23 02.8	0.0	58.0
06	270 16.8	N 6 55.6	176 09.2	6.6	S23 02.8	0.2	58.0
07	285 17.0	54.7	190 34.8	6.8	23 02.6	0.4	58.0
08	300 17.2	53.7	205 00.6	6.7	23 02.2	0.5	57.9
M 09	315 17.4	52.8	219 26.3	6.8	23 01.7	0.6	57.9
O 10	330 17.6	51.9	233 52.1	6.9	23 01.1	0.8	57.9
N 11	345 17.8	51.0	248 18.0	6.9	23 00.3	0.9	57.8
D 12	0 18.0	N 6 50.0	262 43.9	6.9	S22 59.4	1.1	57.8
A 13	15 18.3	49.1	277 09.8	7.0	22 58.3	1.2	57.8
Y 14	30 18.5	48.2	291 35.8	7.1	22 57.1	1.3	57.8
15	45 18.7	47.2	306 01.9	7.0	22 55.8	1.4	57.7
16	60 18.9	46.3	320 27.9	7.2	22 54.4	1.6	57.7
17	75 19.1	45.4	334 54.1	7.1	22 52.8	1.8	57.7
18	90 19.3	N 6 44.5	349 20.2	7.3	S22 51.0	1.9	57.6
19	105 19.5	43.5	3 46.5	7.3	22 49.1	2.0	57.6
20	120 19.7	42.6	18 12.8	7.3	22 47.1	2.1	57.6
21	135 19.9	41.7	32 39.1	7.4	22 45.0	2.3	57.6
22	150 20.1	40.8	47 05.5	7.4	22 42.7	2.4	57.5
23	165 20.4	39.8	61 31.9	7.5	22 40.3	2.5	57.5
6 00	180 20.6	N 6 38.9	75 58.4	7.6	S22 37.8	2.7	57.5
01	195 20.8	38.0	90 25.0	7.6	22 35.1	2.8	57.4
02	210 21.0	37.0	104 51.6	7.7	22 32.3	2.9	57.4
03	225 21.2	36.1	119 18.3	7.7	22 29.4	3.1	57.4
04	240 21.4	35.2	133 45.0	7.8	22 26.3	3.1	57.4
05	255 21.6	34.3	148 11.8	7.8	22 23.2	3.4	57.3
06	270 21.8	N 6 33.3	162 38.6	8.0	S22 19.8	3.4	57.3
07	285 22.0	32.4	177 05.6	7.9	22 16.4	3.6	57.3
T 08	300 22.2	31.5	191 32.5	8.1	22 12.8	3.6	57.2
U 09	315 22.5	30.5	205 59.6	8.1	22 09.2	3.9	57.2
E 10	330 22.7	29.6	220 26.7	8.1	22 05.3	3.9	57.2
S 11	345 22.9	28.7	234 53.8	8.3	22 01.4	4.0	57.2
D 12	0 23.1	N 6 27.7	249 21.1	8.3	S21 57.4	4.2	57.1
A 13	15 23.3	26.8	263 48.4	8.3	21 53.2	4.3	57.1
Y 14	30 23.5	25.9	278 15.7	8.4	21 48.9	4.4	57.1
15	45 23.7	25.0	292 43.1	8.5	21 44.5	4.6	57.1
16	60 23.9	24.0	307 10.6	8.6	21 39.9	4.6	57.0
17	75 24.2	23.1	321 38.2	8.6	21 35.3	4.8	57.0
18	90 24.4	N 6 22.2	336 05.8	8.7	S21 30.5	4.9	57.0
19	105 24.6	21.2	350 33.5	8.8	21 25.6	5.0	56.9
20	120 24.8	20.3	5 01.3	8.9	21 20.6	5.1	56.9
21	135 25.0	19.4	19 29.2	8.9	21 15.5	5.2	56.9
22	150 25.2	18.4	33 57.1	8.9	21 10.3	5.3	56.9
23	165 25.4	17.5	48 25.0	9.1	S21 05.0	5.5	56.8
	SD 15.9	d 0.9	SD	15.9		15.8		15.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 4	Moonrise 5	Moonrise 6	Moonrise 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	////	02 56	04 19				
N 70	01 12	03 19	04 30				19 14
68	02 01	03 36	04 39			18 50	18 23
66	02 30	03 50	04 47	16 34	17 31	17 48	17 51
64	02 52	04 01	04 53	15 44	16 42	17 13	17 28
62	03 09	04 11	04 59	15 13	16 11	16 47	17 09
60	03 23	04 19	05 03	14 49	15 48	16 27	16 53
N 58	03 34	04 26	05 07	14 30	15 29	16 11	16 40
56	03 44	04 32	05 11	14 15	15 13	15 57	16 29
54	03 52	04 38	05 15	14 01	15 00	15 45	16 18
52	04 00	04 43	05 18	13 49	14 48	15 34	16 10
50	04 06	04 47	05 20	13 39	14 37	15 24	16 01
45	04 20	04 56	05 26	13 17	14 15	15 04	15 44
N 40	04 31	05 03	05 31	12 59	13 58	14 48	15 30
35	04 39	05 10	05 35	12 45	13 43	14 34	15 18
30	04 46	05 15	05 39	12 32	13 30	14 22	15 08
20	04 57	05 23	05 45	12 10	13 08	14 01	14 50
N 10	05 05	05 29	05 51	11 51	12 49	13 43	14 34
0	05 11	05 35	05 56	11 33	12 31	13 26	14 19
S 10	05 15	05 39	06 00	11 16	12 13	13 09	14 04
20	05 18	05 43	06 05	10 57	11 54	12 51	13 48
30	05 19	05 47	06 11	10 36	11 32	12 31	13 30
35	05 20	05 49	06 14	10 23	11 19	12 18	13 19
40	05 19	05 51	06 18	10 09	11 04	12 04	13 07
45	05 19	05 53	06 22	09 51	10 47	11 48	12 52
S 50	05 17	05 55	06 27	09 30	10 25	11 27	12 35
52	05 16	05 55	06 29	09 20	10 14	11 17	12 26
54	05 15	05 56	06 32	09 09	10 03	11 06	12 17
56	05 14	05 57	06 34	08 56	09 49	10 54	12 06
58	05 13	05 58	06 37	08 41	09 34	10 39	11 54
S 60	05 11	05 59	06 41	08 23	09 15	10 22	11 40

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 4	Moonset 5	Moonset 6	Moonset 7
°	h m	h m	h m	h m	h m	h m	h m
N 72	19 35	20 57	////				
N 70	19 25	20 35	22 35				22 01
68	19 16	20 18	21 51			20 37	22 51
66	19 09	20 05	21 23	18 58	20 00	21 38	23 22
64	19 03	19 54	21 02	19 48	20 49	22 13	23 45
62	18 57	19 45	20 46	20 20	21 20	22 38	24 03
60	18 53	19 37	20 33	20 43	21 43	22 57	24 18
N 58	18 49	19 30	20 21	21 02	22 02	23 13	24 31
56	18 45	19 24	20 12	21 18	22 18	23 27	24 42
54	18 42	19 19	20 04	21 32	22 31	23 39	24 51
52	18 39	19 14	19 56	21 44	22 43	23 49	25 00
50	18 36	19 10	19 50	21 54	22 53	23 59	25 08
45	18 31	19 01	19 36	22 16	23 15	24 18	00 18
N 40	18 26	18 53	19 26	22 34	23 32	24 34	00 34
35	18 22	18 47	19 18	22 49	23 47	24 47	00 47
30	18 18	18 42	19 11	23 02	24 00	00 00	00 59
20	18 12	18 34	19 00	23 24	24 21	00 21	01 19
N 10	18 07	18 28	18 53	23 43	24 40	00 40	01 36
0	18 02	18 23	18 47	24 01	00 01	00 58	01 52
S 10	17 57	18 18	18 43	24 19	00 19	01 15	02 08
20	17 52	18 15	18 40	24 38	00 38	01 34	02 25
30	17 47	18 11	18 39	25 00	01 00	01 55	02 44
35	17 44	18 09	18 39	00 11	01 13	02 08	02 55
40	17 40	18 07	18 39	00 26	01 28	02 22	03 08
45	17 36	18 06	18 40	00 42	01 45	02 39	03 24
S 50	17 32	18 04	18 41	01 03	02 07	03 00	03 42
52	17 29	18 03	18 42	01 13	02 18	03 10	03 51
54	17 27	18 02	18 43	01 24	02 29	03 21	04 01
56	17 24	18 02	18 45	01 37	02 43	03 34	04 12
58	17 21	18 01	18 46	01 51	02 59	03 49	04 24
S 60	17 18	18 00	18 48	02 09	03 17	04 06	04 39

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
4	00 42	00 52	11 59	17 47	05 18	06	48
5	01 02	01 12	11 59	18 44	06 16	07	58
6	01 22	01 32	11 58	19 39	07 12	08	69

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.7		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
7 00	345 43.8	174 26.0	N 5 16.4	231 17.5	N22 19.7	307 25.8	N13 33.6	150 16.1	S 4 07.4
01	0 46.2	189 25.6	15.1	246 18.3	19.5	322 28.3	33.6	165 18.3	07.6
02	15 48.7	204 25.2	13.9	261 19.1	19.3	337 30.9	33.6	180 20.5	07.7
03	30 51.2	219 24.8	12.6	276 19.8	19.0	352 33.4	33.6	195 22.7	07.8
04	45 53.6	234 24.4	11.4	291 20.6	18.8	7 35.9	33.5	210 24.9	07.9
05	60 56.1	249 24.0	10.2	306 21.4	18.6	22 38.4	33.5	225 27.1	08.0
06	75 58.6	264 23.6	N 5 08.9	321 22.2	N22 18.4	37 41.0	N13 33.5	240 29.3	S 4 08.1
W 07	91 01.0	279 23.2	07.7	336 23.0	18.1	52 43.5	33.4	255 31.6	08.2
E 08	106 03.5	294 22.8	06.5	351 23.8	17.9	67 46.0	33.4	270 33.8	08.3
D 09	121 06.0	309 22.5	05.2	6 24.5	17.7	82 48.5	33.4	285 36.0	08.4
N 10	136 08.4	324 22.1	04.0	21 25.3	17.4	97 51.1	33.4	300 38.2	08.5
E 11	151 10.9	339 21.7	02.7	36 26.1	17.2	112 53.6	33.3	315 40.4	08.6
S 12	166 13.3	354 21.3	N 5 01.5	51 26.9	N22 17.0	127 56.1	N13 33.3	330 42.6	S 4 08.8
D 13	181 15.8	9 20.9	5 00.3	66 27.7	16.8	142 58.7	33.3	345 44.8	08.9
A 14	196 18.3	24 20.5	4 59.0	81 28.5	16.5	158 01.2	33.2	0 47.0	09.0
Y 15	211 20.7	39 20.1	57.8	96 29.2	16.3	173 03.7	33.2	15 49.2	09.1
16	226 23.2	54 19.7	56.6	111 30.0	16.1	188 06.2	33.2	30 51.5	09.2
17	241 25.7	69 19.3	55.3	126 30.8	15.8	203 08.8	33.2	45 53.7	09.3
18	256 28.1	84 18.9	N 4 54.1	141 31.6	N22 15.6	218 11.3	N13 33.1	60 55.9	S 4 09.4
19	271 30.6	99 18.6	52.8	156 32.4	15.4	233 13.8	33.1	75 58.1	09.5
20	286 33.1	114 18.2	51.6	171 33.2	15.2	248 16.4	33.1	91 00.3	09.6
21	301 35.5	129 17.8	50.4	186 34.0	14.9	263 18.9	33.0	106 02.5	09.7
22	316 38.0	144 17.4	49.1	201 34.8	14.7	278 21.4	33.0	121 04.7	09.9
23	331 40.5	159 17.0	47.9	216 35.5	14.5	293 23.9	33.0	136 06.9	10.0
8 00	346 42.9	174 16.6	N 4 46.6	231 36.3	N22 14.2	308 26.5	N13 32.9	151 09.1	S 4 10.1
01	1 45.4	189 16.2	45.4	246 37.1	14.0	323 29.0	32.9	166 11.3	10.2
02	16 47.8	204 15.8	44.2	261 37.9	13.8	338 31.5	32.9	181 13.6	10.3
03	31 50.3	219 15.4	42.9	276 38.7	13.5	353 34.1	32.9	196 15.8	10.4
04	46 52.8	234 15.1	41.7	291 39.5	13.3	8 36.6	32.8	211 18.0	10.5
05	61 55.2	249 14.7	40.4	306 40.3	13.1	23 39.1	32.8	226 20.2	10.6
06	76 57.7	264 14.3	N 4 39.2	321 41.1	N22 12.8	38 41.7	N13 32.8	241 22.4	S 4 10.7
07	92 00.2	279 13.9	37.9	336 41.8	12.6	53 44.2	32.7	256 24.6	10.8
T 08	107 02.6	294 13.5	36.7	351 42.6	12.4	68 46.7	32.7	271 26.8	11.0
H 09	122 05.1	309 13.1	35.5	6 43.4	12.1	83 49.3	32.7	286 29.0	11.1
U 10	137 07.6	324 12.7	34.2	21 44.2	11.9	98 51.8	32.6	301 31.2	11.2
R 11	152 10.0	339 12.3	33.0	36 45.0	11.7	113 54.3	32.6	316 33.4	11.3
S 12	167 12.5	354 12.0	N 4 31.7	51 45.8	N22 11.4	128 56.9	N13 32.6	331 35.7	S 4 11.4
D 13	182 15.0	9 11.6	30.5	66 46.6	11.2	143 59.4	32.5	346 37.9	11.5
A 14	197 17.4	24 11.2	29.2	81 47.4	11.0	159 02.0	32.5	1 40.1	11.6
Y 15	212 19.9	39 10.8	28.0	96 48.2	10.7	174 04.5	32.5	16 42.3	11.7
16	227 22.3	54 10.4	26.7	111 49.0	10.5	189 07.0	32.5	31 44.5	11.8
17	242 24.8	69 10.0	25.5	126 49.7	10.3	204 09.6	32.4	46 46.7	11.9
18	257 27.3	84 09.6	N 4 24.3	141 50.5	N22 10.0	219 12.1	N13 32.4	61 48.9	S 4 12.1
19	272 29.7	99 09.3	23.0	156 51.3	09.8	234 14.6	32.4	76 51.1	12.2
20	287 32.2	114 08.9	21.8	171 52.1	09.6	249 17.2	32.3	91 53.3	12.3
21	302 34.7	129 08.5	20.5	186 52.9	09.3	264 19.7	32.3	106 55.5	12.4
22	317 37.1	144 08.1	19.3	201 53.7	09.1	279 22.3	32.3	121 57.7	12.5
23	332 39.6	159 07.7	18.0	216 54.5	08.9	294 24.8	32.2	136 59.9	12.6
9 00	347 42.1	174 07.3	N 4 16.8	231 55.3	N22 08.6	309 27.3	N13 32.2	152 02.2	S 4 12.7
01	2 44.5	189 06.9	15.5	246 56.1	08.4	324 29.9	32.2	167 04.4	12.8
02	17 47.0	204 06.6	14.3	261 56.9	08.2	339 32.4	32.1	182 06.6	12.9
03	32 49.4	219 06.2	13.0	276 57.7	07.9	354 35.0	32.1	197 08.8	13.0
04	47 51.9	234 05.8	11.8	291 58.5	07.7	9 37.5	32.1	212 11.0	13.2
05	62 54.4	249 05.4	10.5	306 59.3	07.4	24 40.0	32.0	227 13.2	13.3
06	77 56.8	264 05.0	N 4 09.3	322 00.1	N22 07.2	39 42.6	N13 32.0	242 15.4	S 4 13.4
07	92 59.3	279 04.6	08.0	337 00.8	07.0	54 45.1	32.0	257 17.6	13.5
08	108 01.8	294 04.3	06.8	352 01.6	06.7	69 47.7	31.9	272 19.8	13.6
F 09	123 04.2	309 03.9	05.5	7 02.4	06.5	84 50.2	31.9	287 22.0	13.7
R 10	138 06.7	324 03.5	04.3	22 03.2	06.2	99 52.7	31.9	302 24.2	13.8
I 11	153 09.2	339 03.1	03.0	37 04.0	06.0	114 55.3	31.8	317 26.4	13.9
D 12	168 11.6	354 02.7	N 4 01.8	52 04.8	N22 05.8	129 57.8	N13 31.8	332 28.7	S 4 14.0
A 13	183 14.1	9 02.3	4 00.6	67 05.6	05.5	145 00.4	31.8	347 30.9	14.1
Y 14	198 16.6	24 02.0	3 59.3	82 06.4	05.3	160 02.9	31.7	2 33.1	14.3
15	213 19.0	39 01.6	58.1	97 07.2	05.0	175 05.5	31.7	17 35.3	14.4
16	228 21.5	54 01.2	56.8	112 08.0	04.8	190 08.0	31.7	32 37.5	14.5
17	243 23.9	69 00.8	55.6	127 08.8	04.6	205 10.6	31.6	47 39.7	14.6
18	258 26.4	84 00.4	N 3 54.3	142 09.6	N22 04.3	220 13.1	N13 31.6	62 41.9	S 4 14.7
19	273 28.9	99 00.0	53.1	157 10.4	04.1	235 15.6	31.6	77 44.1	14.8
20	288 31.3	113 59.7	51.8	172 11.2	03.8	250 18.2	31.5	92 46.3	14.9
21	303 33.8	128 59.3	50.5	187 12.0	03.6	265 20.7	31.5	107 48.5	15.0
22	318 36.3	143 58.9	49.3	202 12.8	03.4	280 23.3	31.4	122 50.7	15.1
23	333 38.7	158 58.5	48.0	217 13.6	03.1	295 25.8	31.4	137 52.9	15.3
Mer. Pass.	h m 0 53.0	v −0.4	d 1.2	v 0.8	d 0.2	v 2.5	d 0.0	v 2.2	d 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 19.0	S40 15.2
Achernar	335 27.2	S57 10.3
Acrux	173 11.4	S63 10.0
Adhara	255 13.7	S28 59.1
Aldebaran	290 50.8	N16 32.0
Alioth	166 22.2	N55 53.9
Alkaid	153 00.2	N49 15.5
Al Na'ir	27 44.8	S46 54.1
Alnilam	275 47.7	S 1 11.6
Alphard	217 57.6	S 8 42.5
Alphecca	126 12.2	N26 40.7
Alpheratz	357 44.5	N29 09.5
Altair	62 09.2	N 8 54.2
Ankaa	353 16.5	S42 14.3
Antares	112 27.8	S26 27.5
Arcturus	145 57.1	N19 07.4
Atria	107 30.8	S69 03.1
Avior	234 19.1	S59 32.7
Bellatrix	278 33.4	N 6 21.7
Betelgeuse	271 02.7	N 7 24.6
Canopus	263 56.9	S52 41.9
Capella	280 36.3	N46 00.4
Deneb	49 32.0	N45 19.7
Denebola	182 35.2	N14 30.4
Diphda	348 56.8	S17 55.1
Dubhe	193 53.8	N61 41.2
Elnath	278 14.2	N28 36.9
Eltanin	90 46.6	N51 29.6
Enif	33 48.0	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.9
Gienah	175 53.9	S17 36.4
Hadar	148 50.2	S60 26.0
Hamal	328 01.9	N23 31.1
Kaus Aust.	83 45.3	S34 22.7
Kochab	137 20.4	N74 06.7
Markab	13 39.3	N15 16.3
Menkar	314 16.2	N 4 08.3
Menkent	148 09.3	S36 25.7
Miaplacidus	221 40.8	S69 45.8
Mirfak	308 42.0	N49 54.0
Nunki	75 59.7	S26 16.8
Peacock	53 20.7	S56 41.8
Pollux	243 29.5	N27 59.8
Procyon	245 01.2	N 5 11.7
Rasalhague	96 07.5	N12 33.3
Regulus	207 45.1	N11 54.6
Rigel	281 13.3	S 8 11.2
Rigil Kent.	139 53.9	S60 53.2
Sabik	102 13.9	S15 44.3
Schedar	349 41.5	N56 36.1
Shaula	96 23.5	S37 06.8
Sirius	258 34.9	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.8	S43 28.7
Vega	80 39.6	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	187 33.7	12 23
Mars	244 53.4	8 33
Jupiter	321 43.6	3 26
Saturn	164 26.2	13 53

UT	SUN			MOON					
	GHA		Dec	GHA	v	Dec	d	HP
d h	° ′		° ′	° ′	′	° ′	′	′
7 00	180 25.6	N	6 16.6	62 53.1	9.1	S20 59.5	5.6	56.8
01	195 25.8		15.6	77 21.2	9.2	20 53.9	5.6	56.8
02	210 26.1		14.7	91 49.4	9.3	20 48.3	5.8	56.8
03	225 26.3		13.8	106 17.7	9.3	20 42.5	5.9	56.7
04	240 26.5		12.8	120 46.0	9.4	20 36.6	6.0	56.7
05	255 26.7		11.9	135 14.4	9.5	20 30.6	6.1	56.7
06	270 26.9	N	6 11.0	149 42.9	9.6	S20 24.5	6.2	56.7
W 07	285 27.1		10.0	164 11.5	9.6	20 18.3	6.3	56.6
E 08	300 27.3		09.1	178 40.1	9.7	20 12.0	6.4	56.6
D 09	315 27.6		08.2	193 08.8	9.8	20 05.6	6.5	56.6
N 10	330 27.8		07.2	207 37.6	9.9	19 59.1	6.6	56.6
E 11	345 28.0		06.3	222 06.5	9.9	19 52.5	6.7	56.5
S 12	0 28.2	N	6 05.4	236 35.4	10.0	S19 45.8	6.8	56.5
D 13	15 28.4		04.4	251 04.4	10.1	19 39.0	6.9	56.5
A 14	30 28.6		03.5	265 33.5	10.1	19 32.1	7.0	56.5
Y 15	45 28.8		02.6	280 02.6	10.2	19 25.1	7.1	56.4
16	60 29.0		01.6	294 31.8	10.3	19 18.0	7.2	56.4
17	75 29.3	6	00.7	309 01.1	10.4	19 10.8	7.2	56.4
18	90 29.5	N	5 59.7	323 30.5	10.4	S19 03.6	7.4	56.4
19	105 29.7		58.8	337 59.9	10.6	18 56.2	7.5	56.3
20	120 29.9		57.9	352 29.5	10.6	18 48.7	7.5	56.3
21	135 30.1		56.9	6 59.1	10.6	18 41.2	7.7	56.3
22	150 30.3		56.0	21 28.7	10.8	18 33.5	7.7	56.3
23	165 30.5		55.1	35 58.5	10.8	18 25.8	7.8	56.2
8 00	180 30.8	N	5 54.1	50 28.3	10.9	S18 18.0	7.9	56.2
01	195 31.0		53.2	64 58.2	10.9	18 10.1	8.0	56.2
02	210 31.2		52.3	79 28.1	11.1	18 02.1	8.1	56.2
03	225 31.4		51.3	93 58.2	11.1	17 54.0	8.1	56.2
04	240 31.6		50.4	108 28.3	11.2	17 45.9	8.3	56.1
05	255 31.8		49.4	122 58.5	11.2	17 37.6	8.3	56.1
06	270 32.1	N	5 48.5	137 28.7	11.4	S17 29.3	8.4	56.1
T 07	285 32.3		47.6	151 59.1	11.4	17 20.9	8.5	56.1
H 08	300 32.5		46.6	166 29.5	11.4	17 12.4	8.5	56.0
U 09	315 32.7		45.7	180 59.9	11.6	17 03.9	8.7	56.0
R 10	330 32.9		44.7	195 30.5	11.6	16 55.2	8.7	56.0
S 11	345 33.1		43.8	210 01.1	11.7	16 46.5	8.7	56.0
D 12	0 33.3	N	5 42.9	224 31.8	11.8	S16 37.8	8.9	56.0
A 13	15 33.6		41.9	239 02.6	11.8	16 28.9	8.9	55.9
Y 14	30 33.8		41.0	253 33.4	11.9	16 20.0	9.0	55.9
15	45 34.0		40.1	268 04.3	12.0	16 11.0	9.1	55.9
16	60 34.2		39.1	282 35.3	12.0	16 01.9	9.1	55.9
17	75 34.4		38.2	297 06.3	12.1	15 52.8	9.3	55.8
18	90 34.6	N	5 37.2	311 37.4	12.2	S15 43.5	9.2	55.8
19	105 34.9		36.3	326 08.6	12.2	15 34.3	9.4	55.8
20	120 35.1		35.4	340 39.8	12.3	15 24.9	9.4	55.8
21	135 35.3		34.4	355 11.1	12.4	15 15.5	9.5	55.8
22	150 35.5		33.5	9 42.5	12.5	15 06.0	9.5	55.7
23	165 35.7		32.5	24 14.0	12.5	14 56.5	9.6	55.7
9 00	180 35.9	N	5 31.6	38 45.5	12.6	S14 46.9	9.7	55.7
01	195 36.2		30.7	53 17.1	12.6	14 37.2	9.7	55.7
02	210 36.4		29.7	67 48.7	12.7	14 27.5	9.8	55.7
03	225 36.6		28.8	82 20.4	12.8	14 17.7	9.8	55.6
04	240 36.8		27.8	96 52.2	12.8	14 07.9	9.9	55.6
05	255 37.0		26.9	111 24.0	12.9	13 58.0	10.0	55.6
06	270 37.2	N	5 25.9	125 55.9	13.0	S13 48.0	10.0	55.6
07	285 37.5		25.0	140 27.9	13.0	13 38.0	10.1	55.6
08	300 37.7		24.1	154 59.9	13.1	13 27.9	10.1	55.5
F 09	315 37.9		23.1	169 32.0	13.2	13 17.8	10.2	55.5
R 10	330 38.1		22.2	184 04.2	13.2	13 07.6	10.2	55.5
I 11	345 38.3		21.2	198 36.4	13.3	12 57.4	10.3	55.5
D 12	0 38.5	N	5 20.3	213 08.7	13.3	S12 47.1	10.3	55.5
A 13	15 38.8		19.3	227 41.0	13.4	12 36.8	10.4	55.4
Y 14	30 39.0		18.4	242 13.4	13.4	12 26.4	10.4	55.4
15	45 39.2		17.5	256 45.8	13.5	12 16.0	10.5	55.4
16	60 39.4		16.5	271 18.3	13.6	12 05.5	10.5	55.4
17	75 39.6		15.6	285 50.9	13.6	11 55.0	10.6	55.4
18	90 39.9	N	5 14.6	300 23.5	13.7	S11 44.4	10.6	55.3
19	105 40.1		13.7	314 56.2	13.7	11 33.8	10.7	55.3
20	120 40.3		12.7	329 28.9	13.8	11 23.1	10.7	55.3
21	135 40.5		11.8	344 01.7	13.9	11 12.4	10.7	55.3
22	150 40.7		10.9	358 34.6	13.8	11 01.7	10.8	55.3
23	165 40.9		09.9	13 07.4	14.0	S10 50.9	10.8	55.3
	SD 15.9		d 0.9	SD 15.4		15.2		15.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 7	Moonrise 8	Moonrise 9	Moonrise 10
	h m	h m	h m	h m	h m	h m	h m
N 72	00 23	03 14	04 33	▬	19 14	18 39	18 16
N 70	01 45	03 34	04 42	19 14	18 38	18 19	18 05
68	02 21	03 49	04 50	18 23	18 12	18 04	17 57
66	02 46	04 01	04 56	17 51	17 52	17 51	17 49
64	03 04	04 11	05 02	17 28	17 36	17 40	17 43
62	03 19	04 20	05 06	17 09	17 22	17 31	17 38
60	03 32	04 27	05 10	16 53	17 11	17 23	17 33
N 58	03 42	04 33	05 14	16 40	17 01	17 17	17 29
56	03 51	04 39	05 17	16 29	16 52	17 10	17 26
54	03 59	04 43	05 20	16 18	16 44	17 05	17 22
52	04 06	04 48	05 22	16 10	16 37	17 00	17 19
50	04 12	04 52	05 25	16 01	16 31	16 56	17 17
45	04 24	05 00	05 30	15 44	16 17	16 46	17 11
N 40	04 34	05 06	05 34	15 30	16 06	16 38	17 06
35	04 42	05 12	05 37	15 18	15 57	16 30	17 01
30	04 48	05 16	05 41	15 08	15 48	16 24	16 57
20	04 58	05 24	05 46	14 50	15 33	16 13	16 51
N 10	05 05	05 29	05 50	14 34	15 21	16 04	16 45
0	05 10	05 34	05 55	14 19	15 08	15 55	16 39
S 10	05 13	05 38	05 59	14 04	14 56	15 46	16 34
20	05 15	05 41	06 03	13 48	14 43	15 37	16 28
30	05 16	05 44	06 07	13 30	14 28	15 26	16 21
35	05 16	05 45	06 10	13 19	14 20	15 19	16 17
40	05 15	05 46	06 13	13 07	14 10	15 12	16 13
45	05 13	05 47	06 16	12 52	13 58	15 03	16 08
S 50	05 11	05 48	06 20	12 35	13 44	14 53	16 01
52	05 10	05 49	06 22	12 26	13 37	14 49	15 58
54	05 08	05 49	06 24	12 17	13 30	14 43	15 55
56	05 06	05 49	06 26	12 06	13 22	14 37	15 52
58	05 04	05 50	06 29	11 54	13 12	14 31	15 48
S 60	05 02	05 50	06 32	11 40	13 02	14 23	15 44

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 7	Moonset 8	Moonset 9	Moonset 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	19 19	20 37	23 06	▬	23 44	25 55	01 55
N 70	19 10	20 18	22 03	22 01	24 19	00 19	02 12
68	19 03	20 04	21 30	22 51	24 43	00 43	02 26
66	18 57	19 52	21 06	23 22	25 02	01 02	02 38
64	18 52	19 42	20 48	23 45	25 17	01 17	02 47
62	18 48	19 34	20 33	24 03	00 03	01 30	02 55
60	18 44	19 27	20 21	24 18	00 18	01 41	03 02
N 58	18 40	19 21	20 11	24 31	00 31	01 50	03 08
56	18 37	19 16	20 03	24 42	00 42	01 58	03 13
54	18 35	19 11	19 55	24 51	00 51	02 05	03 18
52	18 32	19 07	19 48	25 00	01 00	02 11	03 22
50	18 30	19 03	19 43	25 08	01 08	02 17	03 26
45	18 25	18 55	19 30	00 18	01 24	02 30	03 34
N 40	18 21	18 48	19 21	00 34	01 37	02 40	03 41
35	18 18	18 43	19 13	00 47	01 48	02 49	03 47
30	18 15	18 39	19 07	00 59	01 58	02 56	03 52
20	18 09	18 32	18 57	01 19	02 15	03 09	04 01
N 10	18 05	18 26	18 51	01 36	02 30	03 21	04 09
0	18 01	18 22	18 46	01 52	02 43	03 31	04 17
S 10	17 57	18 18	18 43	02 08	02 57	03 42	04 24
20	17 53	18 15	18 41	02 25	03 11	03 53	04 31
30	17 49	18 12	18 40	02 44	03 27	04 06	04 40
35	17 46	18 11	18 41	02 55	03 37	04 13	04 45
40	17 43	18 10	18 42	03 08	03 48	04 21	04 51
45	17 40	18 09	18 43	03 24	04 00	04 31	04 57
S 50	17 36	18 08	18 46	03 42	04 15	04 42	05 05
52	17 34	18 08	18 47	03 51	04 23	04 48	05 09
54	17 32	18 08	18 49	04 01	04 30	04 54	05 12
56	17 30	18 07	18 50	04 12	04 39	05 00	05 17
58	17 28	18 07	18 53	04 24	04 49	05 07	05 22
S 60	17 25	18 07	18 55	04 39	05 01	05 16	05 27

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
7	01 42	01 52	11 58	20 31	08 06	09	78
8	02 03	02 13	11 58	21 20	08 56	10	86
9	02 23	02 34	11 57	22 06	09 43	11	92

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.7		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
10 00	348 41.2	173 58.1	N 3 46.8	232 14.4	N22 02.9	310 28.4	N13 31.4	152 55.1	S 4 15.4
01	3 43.7	188 57.8	45.5	247 15.2	02.6	325 30.9	31.3	167 57.3	15.5
02	18 46.1	203 57.4	44.3	262 16.0	02.4	340 33.5	31.3	182 59.6	15.6
03	33 48.6	218 57.0	43.0	277 16.8	02.1	355 36.0	31.3	198 01.8	15.7
04	48 51.0	233 56.6	41.8	292 17.6	01.9	10 38.6	31.2	213 04.0	15.8
05	63 53.5	248 56.2	40.5	307 18.4	01.7	25 41.1	31.2	228 06.2	15.9
06	78 56.0	263 55.9	N 3 39.3	322 19.2	N22 01.4	40 43.7	N13 31.2	243 08.4	S 4 16.0
07	93 58.4	278 55.5	38.0	337 20.0	01.2	55 46.2	31.1	258 10.6	16.1
S 08	109 00.9	293 55.1	36.8	352 20.8	00.9	70 48.8	31.1	273 12.8	16.3
A 09	124 03.4	308 54.7	35.5	7 21.6	00.7	85 51.3	31.1	288 15.0	16.4
T 10	139 05.8	323 54.3	34.3	22 22.4	00.4	100 53.9	31.0	303 17.2	16.5
U 11	154 08.3	338 54.0	33.0	37 23.2	22 00.2	115 56.4	31.0	318 19.4	16.6
R 12	169 10.8	353 53.6	N 3 31.8	52 24.0	N21 59.9	130 59.0	N13 31.0	333 21.6	S 4 16.7
D 13	184 13.2	8 53.2	30.5	67 24.8	59.7	146 01.5	30.9	348 23.8	16.8
A 14	199 15.7	23 52.8	29.2	82 25.6	59.4	161 04.1	30.9	3 26.0	16.9
Y 15	214 18.2	38 52.4	28.0	97 26.4	59.2	176 06.6	30.8	18 28.2	17.0
16	229 20.6	53 52.1	26.7	112 27.2	59.0	191 09.2	30.8	33 30.4	17.1
17	244 23.1	68 51.7	25.5	127 28.0	58.7	206 11.7	30.8	48 32.7	17.2
18	259 25.5	83 51.3	N 3 24.2	142 28.8	N21 58.5	221 14.3	N13 30.7	63 34.9	S 4 17.4
19	274 28.0	98 50.9	23.0	157 29.6	58.2	236 16.8	30.7	78 37.1	17.5
20	289 30.5	113 50.5	21.7	172 30.4	58.0	251 19.4	30.7	93 39.3	17.6
21	304 32.9	128 50.2	20.5	187 31.2	57.7	266 22.0	30.6	108 41.5	17.7
22	319 35.4	143 49.8	19.2	202 32.0	57.5	281 24.5	30.6	123 43.7	17.8
23	334 37.9	158 49.4	18.0	217 32.8	57.2	296 27.1	30.5	138 45.9	17.9
11 00	349 40.3	173 49.0	N 3 16.7	232 33.6	N21 57.0	311 29.6	N13 30.5	153 48.1	S 4 18.0
01	4 42.8	188 48.7	15.4	247 34.4	56.7	326 32.2	30.5	168 50.3	18.1
02	19 45.3	203 48.3	14.2	262 35.2	56.5	341 34.7	30.4	183 52.5	18.2
03	34 47.7	218 47.9	12.9	277 36.1	56.2	356 37.3	30.4	198 54.7	18.4
04	49 50.2	233 47.5	11.7	292 36.9	56.0	11 39.8	30.4	213 56.9	18.5
05	64 52.7	248 47.1	10.4	307 37.7	55.7	26 42.4	30.3	228 59.1	18.6
06	79 55.1	263 46.8	N 3 09.2	322 38.5	N21 55.5	41 45.0	N13 30.3	244 01.3	S 4 18.7
07	94 57.6	278 46.4	07.9	337 39.3	55.2	56 47.5	30.2	259 03.5	18.8
08	110 00.0	293 46.0	06.6	352 40.1	55.0	71 50.1	30.2	274 05.7	18.9
S 09	125 02.5	308 45.6	05.4	7 40.9	54.7	86 52.6	30.2	289 07.9	19.0
U 10	140 05.0	323 45.3	04.1	22 41.7	54.5	101 55.2	30.1	304 10.1	19.1
N 11	155 07.4	338 44.9	02.9	37 42.5	54.2	116 57.8	30.1	319 12.3	19.2
D 12	170 09.9	353 44.5	N 3 01.6	52 43.3	N21 54.0	132 00.3	N13 30.0	334 14.6	S 4 19.4
A 13	185 12.4	8 44.1	3 00.3	67 44.1	53.7	147 02.9	30.0	349 16.8	19.5
Y 14	200 14.8	23 43.8	2 59.1	82 44.9	53.5	162 05.4	30.0	4 19.0	19.6
15	215 17.3	38 43.4	57.8	97 45.7	53.2	177 08.0	29.9	19 21.2	19.7
16	230 19.8	53 43.0	56.6	112 46.5	53.0	192 10.6	29.9	34 23.4	19.8
17	245 22.2	68 42.6	55.3	127 47.4	52.7	207 13.1	29.9	49 25.6	19.9
18	260 24.7	83 42.3	N 2 54.1	142 48.2	N21 52.5	222 15.7	N13 29.8	64 27.8	S 4 20.0
19	275 27.1	98 41.9	52.8	157 49.0	52.2	237 18.2	29.8	79 30.0	20.1
20	290 29.6	113 41.5	51.5	172 49.8	52.0	252 20.8	29.7	94 32.2	20.2
21	305 32.1	128 41.1	50.3	187 50.6	51.7	267 23.4	29.7	109 34.4	20.4
22	320 34.5	143 40.7	49.0	202 51.4	51.5	282 25.9	29.7	124 36.6	20.5
23	335 37.0	158 40.4	47.8	217 52.2	51.2	297 28.5	29.6	139 38.8	20.6
12 00	350 39.5	173 40.0	N 2 46.5	232 53.0	N21 50.9	312 31.1	N13 29.6	154 41.0	S 4 20.7
01	5 41.9	188 39.6	45.2	247 53.8	50.7	327 33.6	29.5	169 43.2	20.8
02	20 44.4	203 39.2	44.0	262 54.6	50.4	342 36.2	29.5	184 45.4	20.9
03	35 46.9	218 38.9	42.7	277 55.4	50.2	357 38.7	29.5	199 47.6	21.0
04	50 49.3	233 38.5	41.4	292 56.3	49.9	12 41.3	29.4	214 49.8	21.1
05	65 51.8	248 38.1	40.2	307 57.1	49.7	27 43.9	29.4	229 52.0	21.3
06	80 54.3	263 37.7	N 2 38.9	322 57.9	N21 49.4	42 46.4	N13 29.3	244 54.2	S 4 21.4
07	95 56.7	278 37.4	37.7	337 58.7	49.2	57 49.0	29.3	259 56.4	21.5
08	110 59.2	293 37.0	36.4	352 59.5	48.9	72 51.6	29.2	274 58.6	21.6
M 09	126 01.6	308 36.6	35.1	8 00.3	48.6	87 54.1	29.2	290 00.8	21.7
O 10	141 04.1	323 36.3	33.9	23 01.1	48.4	102 56.7	29.2	305 03.0	21.8
N 11	156 06.6	338 35.9	32.6	38 01.9	48.1	117 59.3	29.1	320 05.2	21.9
D 12	171 09.0	353 35.5	N 2 31.4	53 02.8	N21 47.9	133 01.8	N13 29.1	335 07.5	S 4 22.0
A 13	186 11.5	8 35.1	30.1	68 03.6	47.6	148 04.4	29.0	350 09.7	22.1
Y 14	201 14.0	23 34.8	28.8	83 04.4	47.4	163 07.0	29.0	5 11.9	22.3
15	216 16.4	38 34.4	27.6	98 05.2	47.1	178 09.5	29.0	20 14.1	22.4
16	231 18.9	53 34.0	26.3	113 06.0	46.8	193 12.1	28.9	35 16.3	22.5
17	246 21.4	68 33.6	25.0	128 06.8	46.6	208 14.7	28.9	50 18.5	22.6
18	261 23.8	83 33.3	N 2 23.8	143 07.6	N21 46.3	223 17.3	N13 28.8	65 20.7	S 4 22.7
19	276 26.3	98 32.9	22.5	158 08.5	46.1	238 19.8	28.8	80 22.9	22.8
20	291 28.7	113 32.5	21.3	173 09.3	45.8	253 22.4	28.8	95 25.1	22.9
21	306 31.2	128 32.1	20.0	188 10.1	45.6	268 25.0	28.7	110 27.3	23.0
22	321 33.7	143 31.8	18.7	203 10.9	45.3	283 27.5	28.7	125 29.5	23.1
23	336 36.1	158 31.4	17.5	218 11.7	45.0	298 30.1	28.6	140 31.7	23.3
	h m								
Mer. Pass.	0 41.2	*v* −0.4	*d* 1.3	*v* 0.8	*d* 0.3	*v* 2.6	*d* 0.0	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.0	S40 15.2
Achernar	335 27.1	S57 10.3
Acrux	173 11.4	S63 10.0
Adhara	255 13.7	S28 59.1
Aldebaran	290 50.8	N16 32.0
Alioth	166 22.2	N55 53.9
Alkaid	153 00.2	N49 15.5
Al Na'ir	27 44.8	S46 54.1
Alnilam	275 47.7	S 1 11.6
Alphard	217 57.6	S 8 42.5
Alphecca	126 12.2	N26 40.7
Alpheratz	357 44.5	N29 09.5
Altair	62 09.2	N 8 54.2
Ankaa	353 16.5	S42 14.3
Antares	112 27.8	S26 27.5
Arcturus	145 57.1	N19 07.4
Atria	107 30.8	S69 03.1
Avior	234 19.0	S59 32.7
Bellatrix	278 33.4	N 6 21.7
Betelgeuse	271 02.7	N 7 24.6
Canopus	263 56.9	S52 41.9
Capella	280 36.3	N46 00.4
Deneb	49 32.0	N45 19.7
Denebola	182 35.2	N14 30.4
Diphda	348 56.8	S17 55.1
Dubhe	193 53.8	N61 41.2
Elnath	278 14.2	N28 36.9
Eltanin	90 46.6	N51 29.6
Enif	33 48.0	N 9 56.0
Fomalhaut	15 24.9	S29 33.4
Gacrux	172 02.9	S57 10.8
Gienah	175 53.9	S17 36.4
Hadar	148 50.2	S60 25.9
Hamal	328 01.9	N23 31.2
Kaus Aust.	83 45.3	S34 22.7
Kochab	137 20.5	N74 06.7
Markab	13 39.2	N15 16.3
Menkar	314 16.2	N 4 08.3
Menkent	148 09.3	S36 25.7
Miaplacidus	221 40.8	S69 45.8
Mirfak	308 41.9	N49 54.0
Nunki	75 59.7	S26 16.8
Peacock	53 20.7	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.7
Rasalhague	96 07.6	N12 33.3
Regulus	207 45.1	N11 54.6
Rigel	281 13.2	S 8 11.2
Rigil Kent.	139 53.9	S60 53.2
Sabik	102 14.0	S15 44.3
Schedar	349 41.5	N56 36.2
Shaula	96 23.6	S37 06.8
Sirius	258 34.9	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.8	S43 28.7
Vega	80 39.7	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	184 08.7	12 25
Mars	242 53.3	8 29
Jupiter	321 49.3	3 13
Saturn	164 07.8	13 43

UT	SUN			MOON					
	GHA		Dec	GHA	v		Dec	d	HP
d h	° ′		° ′	° ′	′		° ′	′	′
10 00	180 41.2	N	5 09.0	27 40.4	14.0	S	10 40.1	10.9	55.2
01	195 41.4		08.0	42 13.4	14.0		10 29.2	10.9	55.2
02	210 41.6		07.1	56 46.4	14.1		10 18.3	10.9	55.2
03	225 41.8	. .	06.1	71 19.5	14.2		10 07.4	11.0	55.2
04	240 42.0		05.2	85 52.7	14.2		9 56.4	11.0	55.2
05	255 42.3		04.2	100 25.9	14.2		9 45.4	11.1	55.1
06	270 42.5	N	5 03.3	114 59.1	14.3	S	9 34.3	11.0	55.1
07	285 42.7		02.4	129 32.4	14.4		9 23.3	11.2	55.1
S 08	300 42.9		01.4	144 05.8	14.4		9 12.1	11.1	55.1
A 09	315 43.1		5 00.5	158 39.2	14.4		9 01.0	11.2	55.1
T 10	330 43.3		4 59.5	173 12.6	14.5		8 49.8	11.2	55.1
U 11	345 43.6		58.6	187 46.1	14.5		8 38.6	11.2	55.0
R 12	0 43.8	N	4 57.6	202 19.6	14.6	S	8 27.4	11.3	55.0
D 13	15 44.0		56.7	216 53.2	14.6		8 16.1	11.3	55.0
A 14	30 44.2		55.7	231 26.8	14.6		8 04.8	11.3	55.0
Y 15	45 44.4	. .	54.8	246 00.4	14.7		7 53.5	11.4	55.0
16	60 44.7		53.8	260 34.1	14.8		7 42.1	11.4	55.0
17	75 44.9		52.9	275 07.9	14.7		7 30.7	11.4	54.9
18	90 45.1	N	4 51.9	289 41.6	14.8	S	7 19.3	11.4	54.9
19	105 45.3		51.0	304 15.4	14.9		7 07.9	11.4	54.9
20	120 45.5		50.0	318 49.3	14.9		6 56.5	11.5	54.9
21	135 45.8	. .	49.1	333 23.2	14.9		6 45.0	11.5	54.9
22	150 46.0		48.2	347 57.1	15.0		6 33.5	11.5	54.9
23	165 46.2		47.2	2 31.1	15.0		6 22.0	11.5	54.9
11 00	180 46.4	N	4 46.3	17 05.1	15.0	S	6 10.5	11.6	54.8
01	195 46.6		45.3	31 39.1	15.1		5 58.9	11.5	54.8
02	210 46.9		44.4	46 13.2	15.1		5 47.4	11.6	54.8
03	225 47.1	. .	43.4	60 47.3	15.1		5 35.8	11.6	54.8
04	240 47.3		42.5	75 21.4	15.2		5 24.2	11.6	54.8
05	255 47.5		41.5	89 55.6	15.2		5 12.6	11.7	54.8
06	270 47.7	N	4 40.6	104 29.8	15.2	S	5 00.9	11.6	54.8
07	285 48.0		39.6	119 04.0	15.3		4 49.3	11.7	54.7
08	300 48.2		38.7	133 38.3	15.3		4 37.6	11.7	54.7
S 09	315 48.4	. .	37.7	148 12.6	15.3		4 25.9	11.6	54.7
U 10	330 48.6		36.8	162 46.9	15.3		4 14.3	11.7	54.7
N 11	345 48.8		35.8	177 21.2	15.4		4 02.6	11.7	54.7
D 12	0 49.1	N	4 34.9	191 55.6	15.4	S	3 50.9	11.8	54.7
A 13	15 49.3		33.9	206 30.0	15.4		3 39.1	11.7	54.7
Y 14	30 49.5		33.0	221 04.4	15.4		3 27.4	11.7	54.6
15	45 49.7	. .	32.0	235 38.8	15.5		3 15.7	11.8	54.6
16	60 49.9		31.1	250 13.3	15.5		3 03.9	11.7	54.6
17	75 50.2		30.1	264 47.8	15.5		2 52.2	11.7	54.6
18	90 50.4	N	4 29.2	279 22.3	15.5	S	2 40.5	11.8	54.6
19	105 50.6		28.2	293 56.8	15.6		2 28.7	11.8	54.6
20	120 50.8		27.3	308 31.4	15.6		2 16.9	11.7	54.6
21	135 51.0	. .	26.3	323 06.0	15.6		2 05.2	11.8	54.6
22	150 51.3		25.4	337 40.6	15.6		1 53.4	11.8	54.5
23	165 51.5		24.4	352 15.2	15.6		1 41.6	11.7	54.5
12 00	180 51.7	N	4 23.5	6 49.8	15.7	S	1 29.9	11.8	54.5
01	195 51.9		22.5	21 24.5	15.6		1 18.1	11.8	54.5
02	210 52.2		21.6	35 59.1	15.7		1 06.3	11.7	54.5
03	225 52.4	. .	20.6	50 33.8	15.7		0 54.6	11.8	54.5
04	240 52.6		19.7	65 08.5	15.7		0 42.8	11.8	54.5
05	255 52.8		18.7	79 43.2	15.7		0 31.0	11.7	54.5
06	270 53.0	N	4 17.8	94 17.9	15.8	S	0 19.3	11.8	54.4
07	285 53.3		16.8	108 52.7	15.7	S	0 07.5	11.7	54.4
08	300 53.5		15.8	123 27.4	15.8	N	0 04.2	11.8	54.4
M 09	315 53.7	. .	14.9	138 02.2	15.7		0 16.0	11.7	54.4
O 10	330 53.9		13.9	152 36.9	15.8		0 27.7	11.7	54.4
N 11	345 54.1		13.0	167 11.7	15.8		0 39.4	11.8	54.4
D 12	0 54.4	N	4 12.0	181 46.5	15.8	N	0 51.2	11.7	54.4
A 13	15 54.6		11.1	196 21.3	15.8		1 02.9	11.7	54.4
Y 14	30 54.8		10.1	210 56.1	15.8		1 14.6	11.7	54.4
15	45 55.0	. .	09.2	225 30.9	15.8		1 26.3	11.7	54.3
16	60 55.3		08.2	240 05.7	15.8		1 38.0	11.7	54.3
17	75 55.5		07.3	254 40.5	15.8		1 49.7	11.6	54.3
18	90 55.7	N	4 06.3	269 15.3	15.8	N	2 01.3	11.7	54.3
19	105 55.9		05.4	283 50.1	15.9		2 13.0	11.6	54.3
20	120 56.1		04.4	298 25.0	15.8		2 24.6	11.6	54.3
21	135 56.4	. .	03.5	312 59.8	15.8		2 36.2	11.6	54.3
22	150 56.6		02.5	327 34.6	15.9		2 47.8	11.6	54.3
23	165 56.8		01.5	342 09.5	15.8	N	2 59.4	11.6	54.3
	SD 15.9		d 0.9	SD 15.0			14.9		14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 10	Moonrise 11	Moonrise 12	Moonrise 13
°	h m	h m	h m	h m	h m	h m	h m
N 72	01 23	03 31	04 47	18 16	17 57	17 39	17 22
N 70	02 09	03 48	04 55	18 05	17 53	17 42	17 31
68	02 38	04 01	05 01	17 57	17 50	17 44	17 38
66	03 00	04 12	05 06	17 49	17 48	17 46	17 44
64	03 16	04 21	05 10	17 43	17 45	17 47	17 49
62	03 30	04 28	05 14	17 38	17 43	17 49	17 54
60	03 41	04 34	05 17	17 33	17 42	17 50	17 58
N 58	03 50	04 40	05 20	17 29	17 40	17 51	18 01
56	03 58	04 45	05 23	17 26	17 39	17 52	18 05
54	04 05	04 49	05 25	17 22	17 38	17 52	18 07
52	04 11	04 53	05 27	17 19	17 37	17 53	18 10
50	04 17	04 56	05 29	17 17	17 36	17 54	18 12
45	04 28	05 04	05 33	17 11	17 33	17 55	18 18
N 40	04 37	05 09	05 37	17 06	17 32	17 57	18 22
35	04 44	05 14	05 40	17 01	17 30	17 58	18 26
30	04 50	05 18	05 42	16 57	17 28	17 59	18 29
20	04 58	05 24	05 46	16 51	17 26	18 00	18 35
N 10	05 05	05 29	05 50	16 45	17 24	18 02	18 40
0	05 09	05 33	05 53	16 39	17 22	18 03	18 45
S 10	05 11	05 36	05 57	16 34	17 20	18 05	18 50
20	05 13	05 38	06 00	16 28	17 18	18 07	18 55
30	05 12	05 40	06 04	16 21	17 15	18 08	19 01
35	05 11	05 41	06 06	16 17	17 14	18 09	19 05
40	05 10	05 41	06 08	16 13	17 12	18 11	19 09
45	05 08	05 42	06 11	16 08	17 10	18 12	19 13
S 50	05 04	05 42	06 14	16 01	17 08	18 14	19 19
52	05 03	05 42	06 15	15 58	17 07	18 15	19 22
54	05 01	05 42	06 17	15 55	17 06	18 15	19 24
56	04 59	05 42	06 19	15 52	17 05	18 16	19 28
58	04 56	05 41	06 21	15 48	17 03	18 17	19 31
S 60	04 53	05 41	06 23	15 44	17 02	18 19	19 35

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 10	Moonset 11	Moonset 12	Moonset 13
°	h m	h m	h m	h m	h m	h m	h m
N 72	19 04	20 18	22 20	01 55	03 49	05 36	07 21
N 70	18 56	20 02	21 38	02 12	03 57	05 37	07 15
68	18 50	19 49	21 11	02 26	04 04	05 37	07 10
66	18 46	19 39	20 50	02 38	04 09	05 38	07 05
64	18 41	19 31	20 34	02 47	04 14	05 38	07 01
62	18 38	19 24	20 21	02 55	04 18	05 38	06 58
60	18 35	19 17	20 11	03 02	04 21	05 39	06 55
N 58	18 32	19 12	20 01	03 08	04 24	05 39	06 53
56	18 29	19 07	19 54	03 13	04 27	05 39	06 51
54	18 27	19 03	19 47	03 18	04 29	05 39	06 49
52	18 25	18 59	19 41	03 22	04 32	05 40	06 47
50	18 23	18 56	19 35	03 26	04 34	05 40	06 45
45	18 19	18 49	19 24	03 34	04 38	05 40	06 42
N 40	18 16	18 43	19 16	03 41	04 41	05 40	06 39
35	18 13	18 39	19 09	03 47	04 45	05 41	06 36
30	18 11	18 35	19 03	03 52	04 47	05 41	06 34
20	18 07	18 29	18 55	04 01	04 52	05 41	06 30
N 10	18 03	18 24	18 49	04 09	04 56	05 42	06 27
0	18 00	18 21	18 45	04 17	05 00	05 42	06 23
S 10	17 57	18 18	18 42	04 24	05 04	05 42	06 20
20	17 54	18 16	18 41	04 31	05 08	05 42	06 17
30	17 50	18 14	18 42	04 40	05 12	05 43	06 13
35	17 48	18 13	18 43	04 45	05 15	05 43	06 11
40	17 46	18 13	18 44	04 51	05 18	05 43	06 08
45	17 43	18 13	18 47	04 57	05 21	05 43	06 05
S 50	17 40	18 13	18 50	05 05	05 25	05 44	06 02
52	17 39	18 13	18 52	05 09	05 27	05 44	06 00
54	17 38	18 13	18 54	05 12	05 29	05 44	05 59
56	17 36	18 13	18 56	05 17	05 31	05 44	05 57
58	17 34	18 13	18 59	05 22	05 33	05 44	05 55
S 60	17 32	18 14	19 02	05 27	05 36	05 44	05 52

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
10	02 44	02 55	11 57	22 50	10 28	12	96
11	03 05	03 16	11 57	23 32	11 11	13	99
12	03 26	03 37	11 56	24 13	11 53	14	100

UT	ARIES	VENUS −3.9		MARS +1.4		JUPITER −2.7		SATURN +0.9	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
13 00	351 38.6	173 31.0	N 2 16.2	233 12.5	N21 44.8	313 32.7	N13 28.6	155 33.9	S 4 23.4
01	6 41.1	188 30.7	14.9	248 13.4	44.5	328 35.2	28.5	170 36.1	23.5
02	21 43.5	203 30.3	13.7	263 14.2	44.3	343 37.8	28.5	185 38.3	23.6
03	36 46.0	218 29.9	12.4	278 15.0	44.0	358 40.4	28.5	200 40.5	23.7
04	51 48.5	233 29.5	11.1	293 15.8	43.7	13 43.0	28.4	215 42.7	23.8
05	66 50.9	248 29.2	09.9	308 16.6	43.5	28 45.5	28.4	230 44.9	23.9
06	81 53.4	263 28.8	N 2 08.6	323 17.4	N21 43.2	43 48.1	N13 28.3	245 47.1	S 4 24.0
07	96 55.9	278 28.4	07.3	338 18.3	43.0	58 50.7	28.3	260 49.3	24.2
08	111 58.3	293 28.0	06.1	353 19.1	42.7	73 53.3	28.2	275 51.5	24.3
T 09	127 00.8	308 27.7	04.8	8 19.9	42.4	88 55.8	28.2	290 53.7	24.4
U 10	142 03.2	323 27.3	03.5	23 20.7	42.2	103 58.4	28.1	305 55.9	24.5
E 11	157 05.7	338 26.9	02.3	38 21.5	41.9	119 01.0	28.1	320 58.1	24.6
S 12	172 08.2	353 26.6	N 2 01.0	53 22.3	N21 41.6	134 03.6	N13 28.1	336 00.3	S 4 24.7
D 13	187 10.6	8 26.2	1 59.8	68 23.2	41.4	149 06.1	28.0	351 02.5	24.8
A 14	202 13.1	23 25.8	58.5	83 24.0	41.1	164 08.7	28.0	6 04.7	24.9
Y 15	217 15.6	38 25.4	57.2	98 24.8	40.9	179 11.3	27.9	21 06.9	25.0
16	232 18.0	53 25.1	56.0	113 25.6	40.6	194 13.9	27.9	36 09.1	25.2
17	247 20.5	68 24.7	54.7	128 26.4	40.3	209 16.4	27.8	51 11.3	25.3
18	262 23.0	83 24.3	N 1 53.4	143 27.3	N21 40.1	224 19.0	N13 27.8	66 13.5	S 4 25.4
19	277 25.4	98 24.0	52.2	158 28.1	39.8	239 21.6	27.8	81 15.7	25.5
20	292 27.9	113 23.6	50.9	173 28.9	39.5	254 24.2	27.7	96 17.9	25.6
21	307 30.3	128 23.2	49.6	188 29.7	39.3	269 26.8	27.7	111 20.1	25.7
22	322 32.8	143 22.8	48.4	203 30.6	39.0	284 29.3	27.6	126 22.3	25.8
23	337 35.3	158 22.5	47.1	218 31.4	38.7	299 31.9	27.6	141 24.5	25.9
14 00	352 37.7	173 22.1	N 1 45.8	233 32.2	N21 38.5	314 34.5	N13 27.5	156 26.7	S 4 26.1
01	7 40.2	188 21.7	44.6	248 33.0	38.2	329 37.1	27.5	171 28.9	26.2
02	22 42.7	203 21.4	43.3	263 33.8	37.9	344 39.7	27.4	186 31.1	26.3
03	37 45.1	218 21.0	42.0	278 34.7	37.7	359 42.2	27.4	201 33.3	26.4
04	52 47.6	233 20.6	40.8	293 35.5	37.4	14 44.8	27.3	216 35.5	26.5
05	67 50.1	248 20.2	39.5	308 36.3	37.1	29 47.4	27.3	231 37.7	26.6
06	82 52.5	263 19.9	N 1 38.2	323 37.1	N21 36.9	44 50.0	N13 27.3	246 39.9	S 4 26.7
W 07	97 55.0	278 19.5	36.9	338 38.0	36.6	59 52.6	27.2	261 42.1	26.8
E 08	112 57.5	293 19.1	35.7	353 38.8	36.3	74 55.1	27.2	276 44.3	27.0
D 09	127 59.9	308 18.8	34.4	8 39.6	36.1	89 57.7	27.1	291 46.5	27.1
N 10	143 02.4	323 18.4	33.1	23 40.4	35.8	105 00.3	27.1	306 48.7	27.2
E 11	158 04.8	338 18.0	31.9	38 41.3	35.5	120 02.9	27.0	321 50.9	27.3
S 12	173 07.3	353 17.7	N 1 30.6	53 42.1	N21 35.3	135 05.5	N13 27.0	336 53.1	S 4 27.4
D 13	188 09.8	8 17.3	29.3	68 42.9	35.0	150 08.1	26.9	351 55.4	27.5
A 14	203 12.2	23 16.9	28.1	83 43.7	34.7	165 10.6	26.9	6 57.6	27.6
Y 15	218 14.7	38 16.5	26.8	98 44.6	34.5	180 13.2	26.8	21 59.8	27.7
16	233 17.2	53 16.2	25.5	113 45.4	34.2	195 15.8	26.8	37 02.0	27.9
17	248 19.6	68 15.8	24.3	128 46.2	33.9	210 18.4	26.7	52 04.2	28.0
18	263 22.1	83 15.4	N 1 23.0	143 47.0	N21 33.7	225 21.0	N13 26.7	67 06.4	S 4 28.1
19	278 24.6	98 15.1	21.7	158 47.9	33.4	240 23.6	26.7	82 08.6	28.2
20	293 27.0	113 14.7	20.5	173 48.7	33.1	255 26.1	26.6	97 10.8	28.3
21	308 29.5	128 14.3	19.2	188 49.5	32.9	270 28.7	26.6	112 13.0	28.4
22	323 31.9	143 14.0	17.9	203 50.3	32.6	285 31.3	26.5	127 15.2	28.5
23	338 34.4	158 13.6	16.6	218 51.2	32.3	300 33.9	26.5	142 17.4	28.6
15 00	353 36.9	173 13.2	N 1 15.4	233 52.0	N21 32.0	315 36.5	N13 26.4	157 19.6	S 4 28.8
01	8 39.3	188 12.8	14.1	248 52.8	31.8	330 39.1	26.4	172 21.8	28.9
02	23 41.8	203 12.5	12.8	263 53.7	31.5	345 41.7	26.3	187 24.0	29.0
03	38 44.3	218 12.1	11.6	278 54.5	31.2	0 44.3	26.3	202 26.2	29.1
04	53 46.7	233 11.7	10.3	293 55.3	31.0	15 46.8	26.2	217 28.4	29.2
05	68 49.2	248 11.4	09.0	308 56.1	30.7	30 49.4	26.2	232 30.6	29.3
06	83 51.7	263 11.0	N 1 07.8	323 57.0	N21 30.4	45 52.0	N13 26.1	247 32.8	S 4 29.4
07	98 54.1	278 10.6	06.5	338 57.8	30.1	60 54.6	26.1	262 35.0	29.5
T 08	113 56.6	293 10.3	05.2	353 58.6	29.9	75 57.2	26.0	277 37.2	29.7
H 09	128 59.1	308 09.9	03.9	8 59.5	29.6	90 59.8	26.0	292 39.4	29.8
U 10	144 01.5	323 09.5	02.7	24 00.3	29.3	106 02.4	25.9	307 41.6	29.9
R 11	159 04.0	338 09.2	01.4	39 01.1	29.1	121 05.0	25.9	322 43.8	30.0
S 12	174 06.4	353 08.8	N 1 00.1	54 02.0	N21 28.8	136 07.6	N13 25.8	337 46.0	S 4 30.1
D 13	189 08.9	8 08.4	0 58.9	69 02.8	28.5	151 10.2	25.8	352 48.2	30.2
A 14	204 11.4	23 08.0	57.6	84 03.6	28.2	166 12.7	25.7	7 50.3	30.3
Y 15	219 13.8	38 07.7	56.3	99 04.4	28.0	181 15.3	25.7	22 52.5	30.4
16	234 16.3	53 07.3	55.1	114 05.3	27.7	196 17.9	25.6	37 54.7	30.6
17	249 18.8	68 06.9	53.8	129 06.1	27.4	211 20.5	25.6	52 56.9	30.7
18	264 21.2	83 06.6	N 0 52.5	144 06.9	N21 27.1	226 23.1	N13 25.5	67 59.1	S 4 30.8
19	279 23.7	98 06.2	51.2	159 07.8	26.9	241 25.7	25.5	83 01.3	30.9
20	294 26.2	113 05.8	50.0	174 08.6	26.6	256 28.3	25.5	98 03.5	31.0
21	309 28.6	128 05.5	48.7	189 09.4	26.3	271 30.9	25.4	113 05.7	31.1
22	324 31.1	143 05.1	47.4	204 10.3	26.0	286 33.5	25.4	128 07.9	31.2
23	339 33.6	158 04.7	46.2	219 11.1	25.8	301 36.1	25.3	143 10.1	31.3
	h m								
Mer. Pass.	0 29.4	*v* −0.4	*d* 1.3	*v* 0.8	*d* 0.3	*v* 2.6	*d* 0.0	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.0	S40 15.2
Achernar	335 27.1	S57 10.3
Acrux	173 11.4	S63 10.0
Adhara	255 13.6	S28 59.1
Aldebaran	290 50.7	N16 32.0
Alioth	166 22.2	N55 53.9
Alkaid	153 00.2	N49 15.4
Al Na'ir	27 44.8	S46 54.1
Alnilam	275 47.6	S 1 11.6
Alphard	217 57.6	S 8 42.5
Alphecca	126 12.2	N26 40.7
Alpheratz	357 44.5	N29 09.5
Altair	62 09.3	N 8 54.2
Ankaa	353 16.5	S42 14.3
Antares	112 27.9	S26 27.5
Arcturus	145 57.1	N19 07.4
Atria	107 30.9	S69 03.1
Avior	234 19.0	S59 32.7
Bellatrix	278 33.3	N 6 21.7
Betelgeuse	271 02.7	N 7 24.6
Canopus	263 56.8	S52 41.9
Capella	280 36.3	N46 00.4
Deneb	49 32.0	N45 19.7
Denebola	182 35.2	N14 30.4
Diphda	348 56.8	S17 55.1
Dubhe	193 53.8	N61 41.2
Elnath	278 14.2	N28 36.9
Eltanin	90 46.6	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.8
Gienah	175 53.9	S17 36.4
Hadar	148 50.2	S60 25.9
Hamal	328 01.9	N23 31.2
Kaus Aust.	83 45.3	S34 22.7
Kochab	137 20.5	N74 06.7
Markab	13 39.3	N15 16.4
Menkar	314 16.2	N 4 08.3
Menkent	148 09.4	S36 25.7
Miaplacidus	221 40.8	S69 45.8
Mirfak	308 41.9	N49 54.1
Nunki	75 59.7	S26 16.8
Peacock	53 20.7	S56 41.8
Pollux	243 29.4	N27 59.8
Procyon	245 01.2	N 5 11.7
Rasalhague	96 07.6	N12 33.3
Regulus	207 45.1	N11 54.6
Rigel	281 13.2	S 8 11.2
Rigil Kent.	139 53.9	S60 53.2
Sabik	102 14.0	S15 44.3
Schedar	349 41.5	N56 36.2
Shaula	96 23.6	S37 06.8
Sirius	258 34.9	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.7	S43 28.7
Vega	80 39.7	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	180 44.4	12 27
Mars	240 54.5	8 25
Jupiter	321 56.8	3 01
Saturn	163 49.0	13 32

UT	SUN			MOON						
	GHA		Dec	GHA		v		Dec		d	HP
d h	°	′	° ′	°	′	′		°	′	′	′
13 00	180	57.0	N 4 00.6	356	44.3	15.8	N	3	11.0	11.6	54.3
01	195	57.2	3 59.6	11	19.1	15.8		3	22.6	11.5	54.2
02	210	57.5	58.7	25	53.9	15.9		3	34.1	11.5	54.2
03	225	57.7	. . 57.7	40	28.8	15.8		3	45.6	11.6	54.2
04	240	57.9	56.8	55	03.6	15.8		3	57.2	11.4	54.2
05	255	58.1	55.8	69	38.4	15.8		4	08.6	11.5	54.2
06	270	58.4	N 3 54.9	84	13.2	15.8	N	4	20.1	11.5	54.2
07	285	58.6	53.9	98	48.0	15.8		4	31.6	11.4	54.2
T 08	300	58.8	53.0	113	22.8	15.8		4	43.0	11.4	54.2
U 09	315	59.0	. . 52.0	127	57.6	15.8		4	54.4	11.4	54.2
E 10	330	59.2	51.0	142	32.4	15.8		5	05.8	11.3	54.2
S 11	345	59.5	50.1	157	07.2	15.8		5	17.1	11.3	54.2
D 12	0	59.7	N 3 49.1	171	42.0	15.7	N	5	28.4	11.3	54.2
A 13	15	59.9	48.2	186	16.7	15.8		5	39.7	11.3	54.2
Y 14	31	00.1	47.2	200	51.5	15.7		5	51.0	11.3	54.1
15	46	00.4	. . 46.3	215	26.2	15.8		6	02.3	11.2	54.1
16	61	00.6	45.3	230	01.0	15.7		6	13.5	11.2	54.1
17	76	00.8	44.3	244	35.7	15.7		6	24.7	11.2	54.1
18	91	01.0	N 3 43.4	259	10.4	15.7	N	6	35.9	11.1	54.1
19	106	01.3	42.4	273	45.1	15.7		6	47.0	11.1	54.1
20	121	01.5	41.5	288	19.8	15.6		6	58.1	11.1	54.1
21	136	01.7	. . 40.5	302	54.4	15.7		7	09.2	11.1	54.1
22	151	01.9	39.6	317	29.1	15.6		7	20.3	11.0	54.1
23	166	02.1	38.6	332	03.7	15.7		7	31.3	11.0	54.1
14 00	181	02.4	N 3 37.6	346	38.4	15.6	N	7	42.3	10.9	54.1
01	196	02.6	36.7	1	13.0	15.5		7	53.2	10.9	54.1
02	211	02.8	35.7	15	47.5	15.6		8	04.1	10.9	54.1
03	226	03.0	. . 34.8	30	22.1	15.5		8	15.0	10.9	54.1
04	241	03.3	33.8	44	56.6	15.6		8	25.9	10.8	54.1
05	256	03.5	32.9	59	31.2	15.5		8	36.7	10.8	54.1
06	271	03.7	N 3 31.9	74	05.7	15.5	N	8	47.5	10.7	54.1
W 07	286	03.9	30.9	88	40.2	15.4		8	58.2	10.7	54.1
E 08	301	04.2	30.0	103	14.6	15.5		9	08.9	10.7	54.0
D 09	316	04.4	. . 29.0	117	49.1	15.4		9	19.6	10.6	54.0
N 10	331	04.6	28.1	132	23.5	15.4		9	30.2	10.6	54.0
E 11	346	04.8	27.1	146	57.9	15.4		9	40.8	10.5	54.0
S 12	1	05.0	N 3 26.2	161	32.3	15.3	N	9	51.3	10.5	54.0
D 13	16	05.3	25.2	176	06.6	15.3		10	01.8	10.5	54.0
A 14	31	05.5	24.2	190	40.9	15.3		10	12.3	10.4	54.0
Y 15	46	05.7	. . 23.3	205	15.2	15.3		10	22.7	10.4	54.0
16	61	05.9	22.3	219	49.5	15.2		10	33.1	10.3	54.0
17	76	06.2	21.4	234	23.7	15.2		10	43.4	10.3	54.0
18	91	06.4	N 3 20.4	248	57.9	15.2	N	10	53.7	10.2	54.0
19	106	06.6	19.4	263	32.1	15.2		11	03.9	10.2	54.0
20	121	06.8	18.5	278	06.3	15.1		11	14.1	10.2	54.0
21	136	07.1	. . 17.5	292	40.4	15.1		11	24.3	10.1	54.0
22	151	07.3	16.6	307	14.5	15.1		11	34.4	10.0	54.0
23	166	07.5	15.6	321	48.6	15.0		11	44.4	10.1	54.0
15 00	181	07.7	N 3 14.6	336	22.6	15.0	N	11	54.5	9.9	54.0
01	196	07.9	13.7	350	56.6	15.0		12	04.4	9.9	54.0
02	211	08.2	12.7	5	30.6	14.9		12	14.3	9.9	54.0
03	226	08.4	. . 11.8	20	04.5	14.9		12	24.2	9.8	54.0
04	241	08.6	10.8	34	38.4	14.9		12	34.0	9.7	54.0
05	256	08.8	09.8	49	12.3	14.8		12	43.7	9.7	54.0
06	271	09.1	N 3 08.9	63	46.1	14.8	N	12	53.4	9.7	54.0
07	286	09.3	07.9	78	19.9	14.8		13	03.1	9.6	54.0
T 08	301	09.5	07.0	92	53.7	14.7		13	12.7	9.5	54.0
H 09	316	09.7	. . 06.0	107	27.4	14.7		13	22.2	9.5	54.0
U 10	331	10.0	05.0	122	01.1	14.7		13	31.7	9.4	54.0
R 11	346	10.2	04.1	136	34.8	14.6		13	41.1	9.4	54.0
S 12	1	10.4	N 3 03.1	151	08.4	14.6	N	13	50.5	9.3	54.0
D 13	16	10.6	02.2	165	42.0	14.5		13	59.8	9.3	54.0
A 14	31	10.9	01.2	180	15.5	14.5		14	09.1	9.2	54.0
Y 15	46	11.1	3 00.2	194	49.0	14.5		14	18.3	9.1	54.0
16	61	11.3	2 59.3	209	22.5	14.4		14	27.4	9.1	54.0
17	76	11.5	58.3	223	55.9	14.4		14	36.5	9.0	54.0
18	91	11.7	N 2 57.3	238	29.3	14.4	N	14	45.5	9.0	54.0
19	106	12.0	56.4	253	02.7	14.3		14	54.5	8.9	54.0
20	121	12.2	55.4	267	36.0	14.2		15	03.4	8.8	54.0
21	136	12.4	. . 54.5	282	09.2	14.3		15	12.2	8.8	54.0
22	151	12.6	53.5	296	42.5	14.1		15	21.0	8.7	54.0
23	166	12.9	52.5	311	15.6	14.2	N	15	29.7	8.7	54.0
	SD	15.9	d 1.0	SD		14.8			14.7		14.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 13	Moonrise 14	Moonrise 15	Moonrise 16
	h m	h m	h m	h m	h m	h m	h m
N 72	01 55	03 48	05 01	17 22	17 01	16 34	15 32
N 70	02 30	04 02	05 07	17 31	17 18	17 03	16 40
68	02 55	04 13	05 11	17 38	17 32	17 25	17 17
66	03 13	04 22	05 15	17 44	17 43	17 42	17 43
64	03 27	04 30	05 19	17 49	17 52	17 56	18 03
62	03 39	04 36	05 22	17 54	18 00	18 08	18 20
60	03 49	04 42	05 24	17 58	18 07	18 18	18 33
N 58	03 58	04 47	05 27	18 01	18 13	18 27	18 45
56	04 05	04 51	05 29	18 05	18 19	18 35	18 56
54	04 11	04 55	05 31	18 07	18 24	18 42	19 05
52	04 17	04 58	05 32	18 10	18 28	18 49	19 13
50	04 22	05 01	05 34	18 12	18 32	18 54	19 20
45	04 32	05 07	05 37	18 18	18 41	19 07	19 36
N 40	04 40	05 12	05 40	18 22	18 48	19 17	19 49
35	04 46	05 16	05 42	18 26	18 55	19 26	20 00
30	04 52	05 20	05 44	18 29	19 00	19 34	20 10
20	04 59	05 25	05 47	18 35	19 10	19 47	20 27
N 10	05 04	05 29	05 50	18 40	19 19	19 59	20 41
0	05 08	05 32	05 52	18 45	19 27	20 10	20 55
S 10	05 09	05 34	05 55	18 50	19 35	20 22	21 09
20	05 10	05 35	05 57	18 55	19 44	20 34	21 24
30	05 09	05 36	06 00	19 01	19 54	20 47	21 41
35	05 07	05 36	06 02	19 05	20 00	20 56	21 51
40	05 05	05 36	06 03	19 09	20 07	21 05	22 03
45	05 02	05 36	06 05	19 13	20 15	21 16	22 16
S 50	04 58	05 35	06 07	19 19	20 24	21 29	22 33
52	04 56	05 35	06 08	19 22	20 28	21 35	22 41
54	04 53	05 34	06 10	19 24	20 33	21 42	22 50
56	04 51	05 34	06 11	19 28	20 39	21 49	22 59
58	04 47	05 33	06 12	19 31	20 45	21 58	23 11
S 60	04 44	05 32	06 14	19 35	20 51	22 08	23 24

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 13	Moonset 14	Moonset 15	Moonset 16
	h m	h m	h m	h m	h m	h m	h m
N 72	18 48	20 00	21 48	07 21	09 10	11 07	13 41
N 70	18 42	19 46	21 16	07 15	08 54	10 39	12 34
68	18 38	19 36	20 53	07 10	08 43	10 18	11 58
66	18 34	19 27	20 35	07 05	08 33	10 02	11 33
64	18 31	19 19	20 21	07 01	08 25	09 49	11 13
62	18 28	19 13	20 10	06 58	08 18	09 37	10 57
60	18 25	19 08	20 00	06 55	08 12	09 28	10 44
N 58	18 23	19 03	19 52	06 53	08 06	09 20	10 33
56	18 21	18 59	19 45	06 51	08 02	09 13	10 23
54	18 20	18 55	19 38	06 49	07 58	09 06	10 14
52	18 18	18 52	19 33	06 47	07 54	09 00	10 07
50	18 17	18 49	19 28	06 45	07 50	08 55	10 00
45	18 14	18 43	19 18	06 42	07 43	08 44	09 45
N 40	18 11	18 38	19 10	06 39	07 37	08 35	09 33
35	18 09	18 34	19 04	06 36	07 31	08 27	09 22
30	18 07	18 31	18 59	06 34	07 27	08 20	09 13
20	18 04	18 26	18 52	06 30	07 19	08 08	08 58
N 10	18 01	18 22	18 47	06 27	07 12	07 57	08 44
0	17 59	18 20	18 44	06 23	07 05	07 48	08 32
S 10	17 57	18 18	18 42	06 20	06 59	07 38	08 19
20	17 54	18 16	18 42	06 17	06 52	07 28	08 06
30	17 52	18 16	18 43	06 13	06 44	07 16	07 50
35	17 50	18 16	18 45	06 11	06 39	07 09	07 42
40	17 49	18 16	18 47	06 08	06 34	07 01	07 32
45	17 47	18 16	18 50	06 05	06 28	06 52	07 20
S 50	17 45	18 17	18 55	06 02	06 21	06 42	07 05
52	17 44	18 17	18 57	06 00	06 18	06 37	06 59
54	17 43	18 18	18 59	05 59	06 14	06 31	06 52
56	17 42	18 19	19 02	05 57	06 10	06 25	06 43
58	17 40	18 20	19 05	05 55	06 06	06 18	06 34
S 60	17 39	18 20	19 09	05 52	06 01	06 11	06 24

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
13	03 48	03 58	11 56	00 13	12 34	15	99
14	04 09	04 20	11 56	00 55	13 16	16	96
15	04 30	04 41	11 55	01 37	13 59	17	91

UT	ARIES	VENUS −3.9			MARS +1.4			JUPITER −2.8			SATURN +0.8			STARS		
	GHA	GHA	Dec		GHA	Dec		GHA	Dec		GHA	Dec		Name	SHA	Dec
d h	° ′	° ′	° ′		° ′	° ′		° ′	° ′		° ′	° ′			° ′	° ′
16 00	354 36.0	173 04.4	N 0	44.9	234 11.9	N21	25.5	316 38.7	N13	25.3	158 12.3	S 4	31.5	Acamar	315 19.0	S40 15.2
01	9 38.5	188 04.0		43.6	249 12.8		25.2	331 41.3		25.2	173 14.5		31.6	Achernar	335 27.1	S57 10.4
02	24 40.9	203 03.6		42.3	264 13.6		24.9	346 43.9		25.2	188 16.7		31.7	Acrux	173 11.4	S63 09.9
03	39 43.4	218 03.3	. .	41.1	279 14.4	. .	24.7	1 46.5	. .	25.1	203 18.9	. .	31.8	Adhara	255 13.6	S28 59.1
04	54 45.9	233 02.9		39.8	294 15.3		24.4	16 49.1		25.1	218 21.1		31.9	Aldebaran	290 50.7	N16 32.0
05	69 48.3	248 02.5		38.5	309 16.1		24.1	31 51.7		25.0	233 23.3		32.0			
06	84 50.8	263 02.2	N 0	37.2	324 17.0	N21	23.8	46 54.3	N13	25.0	248 25.5	S 4	32.1	Alioth	166 22.2	N55 53.8
07	99 53.3	278 01.8		36.0	339 17.8		23.5	61 56.9		24.9	263 27.7		32.2	Alkaid	153 00.2	N49 15.4
08	114 55.7	293 01.4		34.7	354 18.6		23.3	76 59.5		24.9	278 29.9		32.4	Al Na'ir	27 44.8	S46 54.1
F 09	129 58.2	308 01.0	. .	33.4	9 19.5	. .	23.0	92 02.1	. .	24.8	293 32.1	. .	32.5	Alnilam	275 47.6	S 1 11.6
R 10	145 00.7	323 00.7		32.2	24 20.3		22.7	107 04.6		24.7	308 34.3		32.6	Alphard	217 57.6	S 8 42.5
I 11	160 03.1	338 00.3		30.9	39 21.1		22.4	122 07.2		24.7	323 36.5		32.7			
D 12	175 05.6	352 59.9	N 0	29.6	54 22.0	N21	22.2	137 09.8	N13	24.6	338 38.7	S 4	32.8	Alphecca	126 12.2	N26 40.7
A 13	190 08.0	7 59.6		28.3	69 22.8		21.9	152 12.4		24.6	353 40.9		32.9	Alpheratz	357 44.4	N29 09.5
Y 14	205 10.5	22 59.2		27.1	84 23.6		21.6	167 15.0		24.5	8 43.1		33.0	Altair	62 09.3	N 8 54.2
15	220 13.0	37 58.8	. .	25.8	99 24.5	. .	21.3	182 17.6	. .	24.5	23 45.3	. .	33.1	Ankaa	353 16.4	S42 14.3
16	235 15.4	52 58.5		24.5	114 25.3		21.0	197 20.2		24.4	38 47.5		33.3	Antares	112 27.9	S26 27.5
17	250 17.9	67 58.1		23.2	129 26.2		20.8	212 22.8		24.4	53 49.7		33.4			
18	265 20.4	82 57.7	N 0	22.0	144 27.0	N21	20.5	227 25.4	N13	24.3	68 51.9	S 4	33.5	Arcturus	145 57.1	N19 07.4
19	280 22.8	97 57.4		20.7	159 27.8		20.2	242 28.0		24.3	83 54.1		33.6	Atria	107 30.9	S69 03.1
20	295 25.3	112 57.0		19.4	174 28.7		19.9	257 30.6		24.2	98 56.3		33.7	Avior	234 19.0	S59 32.7
21	310 27.8	127 56.6	. .	18.2	189 29.5	. .	19.6	272 33.2	. .	24.2	113 58.5	. .	33.8	Bellatrix	278 33.3	N 6 21.7
22	325 30.2	142 56.3		16.9	204 30.4		19.4	287 35.9		24.1	129 00.7		33.9	Betelgeuse	271 02.7	N 7 24.6
23	340 32.7	157 55.9		15.6	219 31.2		19.1	302 38.5		24.1	144 02.9		34.1			
17 00	355 35.2	172 55.5	N 0	14.3	234 32.0	N21	18.8	317 41.1	N13	24.0	159 05.1	S 4	34.2	Canopus	263 56.8	S52 41.9
01	10 37.6	187 55.2		13.1	249 32.9		18.5	332 43.7		24.0	174 07.3		34.3	Capella	280 36.2	N46 00.4
02	25 40.1	202 54.8		11.8	264 33.7		18.2	347 46.3		23.9	189 09.5		34.4	Deneb	49 32.0	N45 19.7
03	40 42.5	217 54.4	. .	10.5	279 34.6	. .	17.9	2 48.9	. .	23.9	204 11.7	. .	34.5	Denebola	182 35.2	N14 30.4
04	55 45.0	232 54.1		09.2	294 35.4		17.7	17 51.5		23.8	219 13.9		34.6	Diphda	348 56.8	S17 55.1
05	70 47.5	247 53.7		08.0	309 36.2		17.4	32 54.1		23.8	234 16.1		34.7			
06	85 49.9	262 53.3	N 0	06.7	324 37.1	N21	17.1	47 56.7	N13	23.7	249 18.3	S 4	34.8	Dubhe	193 53.8	N61 41.2
07	100 52.4	277 52.9		05.4	339 37.9		16.8	62 59.3		23.7	264 20.5		35.0	Elnath	278 14.2	N28 36.9
S 08	115 54.9	292 52.6		04.1	354 38.8		16.5	78 01.9		23.6	279 22.7		35.1	Eltanin	90 46.7	N51 29.6
A 09	130 57.3	307 52.2	. .	02.9	9 39.6	. .	16.3	93 04.5	. .	23.6	294 24.9	. .	35.2	Enif	33 48.1	N 9 56.0
T 10	145 59.8	322 51.8		01.6	24 40.4		16.0	108 07.1		23.5	309 27.1		35.3	Fomalhaut	15 25.0	S29 33.4
U 11	161 02.3	337 51.5	N	00.3	39 41.3		15.7	123 09.7		23.4	324 29.3		35.4			
R 12	176 04.7	352 51.1	S 0	00.9	54 42.1	N21	15.4	138 12.3	N13	23.4	339 31.5	S 4	35.5	Gacrux	172 02.9	S57 10.8
D 13	191 07.2	7 50.7		02.2	69 43.0		15.1	153 14.9		23.3	354 33.7		35.6	Gienah	175 53.9	S17 36.4
A 14	206 09.6	22 50.4		03.5	84 43.8		14.8	168 17.5		23.3	9 35.9		35.7	Hadar	148 50.2	S60 25.9
Y 15	221 12.1	37 50.0	. .	04.8	99 44.7	. .	14.6	183 20.1	. .	23.2	24 38.1	. .	35.9	Hamal	328 01.9	N23 31.2
16	236 14.6	52 49.6		06.0	114 45.5		14.3	198 22.7		23.2	39 40.3		36.0	Kaus Aust.	83 45.4	S34 22.7
17	251 17.0	67 49.3		07.3	129 46.3		14.0	213 25.4		23.1	54 42.4		36.1			
18	266 19.5	82 48.9	S 0	08.6	144 47.2	N21	13.7	228 28.0	N13	23.1	69 44.6	S 4	36.2	Kochab	137 20.6	N74 06.6
19	281 22.0	97 48.5		09.9	159 48.0		13.4	243 30.6		23.0	84 46.8		36.3	Markab	13 39.3	N15 16.4
20	296 24.4	112 48.2		11.1	174 48.9		13.1	258 33.2		23.0	99 49.0		36.4	Menkar	314 16.1	N 4 08.3
21	311 26.9	127 47.8	. .	12.4	189 49.7	. .	12.8	273 35.8	. .	22.9	114 51.2	. .	36.5	Menkent	148 09.4	S36 25.7
22	326 29.4	142 47.4		13.7	204 50.6		12.6	288 38.4		22.9	129 53.4		36.7	Miaplacidus	221 40.8	S69 45.8
23	341 31.8	157 47.1		15.0	219 51.4		12.3	303 41.0		22.8	144 55.6		36.8			
18 00	356 34.3	172 46.7	S 0	16.2	234 52.3	N21	12.0	318 43.6	N13	22.7	159 57.8	S 4	36.9	Mirfak	308 41.9	N49 54.1
01	11 36.8	187 46.3		17.5	249 53.1		11.7	333 46.2		22.7	175 00.0		37.0	Nunki	75 59.7	S26 16.8
02	26 39.2	202 46.0		18.8	264 54.0		11.4	348 48.8		22.6	190 02.2		37.1	Peacock	53 20.7	S56 41.8
03	41 41.7	217 45.6	. .	20.1	279 54.8	. .	11.1	3 51.4	. .	22.6	205 04.4	. .	37.2	Pollux	243 29.4	N27 59.7
04	56 44.1	232 45.2		21.3	294 55.7		10.8	18 54.1		22.5	220 06.6		37.3	Procyon	245 01.2	N 5 11.7
05	71 46.6	247 44.9		22.6	309 56.5		10.5	33 56.7		22.5	235 08.8		37.4			
06	86 49.1	262 44.5	S 0	23.9	324 57.3	N21	10.3	48 59.3	N13	22.4	250 11.0	S 4	37.6	Rasalhague	96 07.6	N12 33.3
07	101 51.5	277 44.1		25.2	339 58.2		10.0	64 01.9		22.4	265 13.2		37.7	Regulus	207 45.1	N11 54.6
08	116 54.0	292 43.8		26.4	354 59.0		09.7	79 04.5		22.3	280 15.4		37.8	Rigel	281 13.2	S 8 11.2
S 09	131 56.5	307 43.4	. .	27.7	9 59.9	. .	09.4	94 07.1	. .	22.3	295 17.6	. .	37.9	Rigil Kent.	139 53.9	S60 53.1
U 10	146 58.9	322 43.0		29.0	25 00.7		09.1	109 09.7		22.2	310 19.8		38.0	Sabik	102 14.0	S15 44.3
N 11	162 01.4	337 42.6		30.3	40 01.6		08.8	124 12.4		22.1	325 22.0		38.1			
D 12	177 03.9	352 42.3	S 0	31.5	55 02.4	N21	08.5	139 15.0	N13	22.1	340 24.2	S 4	38.2	Schedar	349 41.5	N56 36.2
A 13	192 06.3	7 41.9		32.8	70 03.3		08.2	154 17.6		22.0	355 26.4		38.4	Shaula	96 23.6	S37 06.8
Y 14	207 08.8	22 41.5		34.1	85 04.1		08.0	169 20.2		22.0	10 28.6		38.5	Sirius	258 34.9	S16 43.8
15	222 11.3	37 41.2	. .	35.4	100 05.0	. .	07.7	184 22.8	. .	21.9	25 30.8	. .	38.6	Spica	158 32.8	S11 13.3
16	237 13.7	52 40.8		36.6	115 05.8		07.4	199 25.4		21.9	40 33.0		38.7	Suhail	222 53.7	S43 28.7
17	252 16.2	67 40.4		37.9	130 06.7		07.1	214 28.0		21.8	55 35.2		38.8			
18	267 18.6	82 40.1	S 0	39.2	145 07.5	N21	06.8	229 30.7	N13	21.7	70 37.4	S 4	38.9	Vega	80 39.7	N38 48.0
19	282 21.1	97 39.7		40.5	160 08.4		06.5	244 33.3		21.7	85 39.5		39.0	Zuben'ubi	137 07.0	S16 05.4
20	297 23.6	112 39.3		41.7	175 09.2		06.2	259 35.9		21.6	100 41.7		39.1		SHA	Mer. Pass.
21	312 26.0	127 39.0	. .	43.0	190 10.1	. .	05.9	274 38.5	. .	21.6	115 43.9	. .	39.3		° ′	h m
22	327 28.5	142 38.6		44.3	205 10.9		05.6	289 41.1		21.5	130 46.1		39.4	Venus	177 20.4	12 29
23	342 31.0	157 38.2		45.6	220 11.8		05.3	304 43.7		21.5	145 48.3		39.5	Mars	238 56.9	8 21
	h m													Jupiter	322 05.9	2 49
Mer. Pass.	0 17.6	v −0.4	d 1.3		v 0.8	d 0.3		v 2.6	d 0.1		v 2.2	d 0.1		Saturn	163 29.9	13 22

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
16 00	181 13.1	N 2 51.6	325 48.8	14.1	N15 38.4	8.6	54.0
01	196 13.3	50.6	340 21.9	14.0	15 47.0	8.5	54.0
02	211 13.5	49.6	354 54.9	14.1	15 55.5	8.4	54.0
03	226 13.8	. . 48.7	9 28.0	13.9	16 03.9	8.4	54.0
04	241 14.0	47.7	24 00.9	13.9	16 12.3	8.3	54.0
05	256 14.2	46.8	38 33.8	13.9	16 20.6	8.3	54.1
06	271 14.4	N 2 45.8	53 06.7	13.9	N16 28.9	8.2	54.1
07	286 14.7	44.8	67 39.6	13.7	16 37.1	8.1	54.1
08	301 14.9	43.9	82 12.3	13.8	16 45.2	8.0	54.1
F 09	316 15.1	. . 42.9	96 45.1	13.7	16 53.2	8.0	54.1
R 10	331 15.3	41.9	111 17.8	13.6	17 01.2	7.9	54.1
I 11	346 15.6	41.0	125 50.4	13.6	17 09.1	7.8	54.1
D 12	1 15.8	N 2 40.0	140 23.0	13.6	N17 16.9	7.7	54.1
A 13	16 16.0	39.1	154 55.6	13.5	17 24.6	7.7	54.1
Y 14	31 16.2	38.1	169 28.1	13.5	17 32.3	7.6	54.1
15	46 16.4	. . 37.1	184 00.6	13.4	17 39.9	7.5	54.1
16	61 16.7	36.2	198 33.0	13.4	17 47.4	7.5	54.1
17	76 16.9	35.2	213 05.4	13.3	17 54.9	7.4	54.1
18	91 17.1	N 2 34.2	227 37.7	13.3	N18 02.3	7.3	54.1
19	106 17.3	33.3	242 10.0	13.2	18 09.6	7.2	54.1
20	121 17.6	32.3	256 42.2	13.2	18 16.8	7.1	54.1
21	136 17.8	. . 31.3	271 14.4	13.1	18 23.9	7.1	54.2
22	151 18.0	30.4	285 46.5	13.1	18 31.0	7.0	54.2
23	166 18.2	29.4	300 18.6	13.0	18 38.0	6.9	54.2
17 00	181 18.5	N 2 28.4	314 50.6	13.0	N18 44.9	6.8	54.2
01	196 18.7	27.5	329 22.6	12.9	18 51.7	6.8	54.2
02	211 18.9	26.5	343 54.5	12.9	18 58.5	6.6	54.2
03	226 19.1	. . 25.6	358 26.4	12.8	19 05.1	6.6	54.2
04	241 19.4	24.6	12 58.2	12.8	19 11.7	6.5	54.2
05	256 19.6	23.6	27 30.0	12.8	19 18.2	6.4	54.2
06	271 19.8	N 2 22.7	42 01.8	12.6	N19 24.6	6.4	54.2
07	286 20.0	21.7	56 33.4	12.7	19 31.0	6.2	54.3
S 08	301 20.2	20.7	71 05.1	12.6	19 37.2	6.2	54.3
A 09	316 20.5	. . 19.8	85 36.7	12.5	19 43.4	6.0	54.3
T 10	331 20.7	18.8	100 08.2	12.5	19 49.4	6.0	54.3
U 11	346 20.9	17.8	114 39.7	12.4	19 55.4	5.9	54.3
R 12	1 21.1	N 2 16.9	129 11.1	12.4	N20 01.3	5.8	54.3
D 13	16 21.4	15.9	143 42.5	12.4	20 07.1	5.7	54.3
A 14	31 21.6	14.9	158 13.9	12.2	20 12.8	5.7	54.3
Y 15	46 21.8	. . 14.0	172 45.1	12.3	20 18.5	5.5	54.3
16	61 22.0	13.0	187 16.4	12.2	20 24.0	5.4	54.4
17	76 22.3	12.0	201 47.6	12.1	20 29.4	5.4	54.4
18	91 22.5	N 2 11.1	216 18.7	12.1	N20 34.8	5.3	54.4
19	106 22.7	10.1	230 49.8	12.0	20 40.1	5.1	54.4
20	121 22.9	09.1	245 20.8	12.0	20 45.2	5.1	54.4
21	136 23.2	. . 08.2	259 51.8	12.0	20 50.3	5.0	54.4
22	151 23.4	07.2	274 22.8	11.8	20 55.3	4.9	54.4
23	166 23.6	06.2	288 53.6	11.9	21 00.2	4.8	54.5
18 00	181 23.8	N 2 05.3	303 24.5	11.8	N21 05.0	4.7	54.5
01	196 24.1	04.3	317 55.3	11.7	21 09.7	4.6	54.5
02	211 24.3	03.3	332 26.0	11.7	21 14.3	4.5	54.5
03	226 24.5	. . 02.4	346 56.7	11.7	21 18.8	4.4	54.5
04	241 24.7	01.4	1 27.4	11.6	21 23.2	4.3	54.5
05	256 24.9	2 00.4	15 58.0	11.5	21 27.5	4.2	54.6
06	271 25.2	N 1 59.5	30 28.5	11.5	N21 31.7	4.1	54.6
07	286 25.4	58.5	44 59.0	11.5	21 35.8	4.1	54.6
08	301 25.6	57.5	59 29.5	11.4	21 39.9	3.9	54.6
S 09	316 25.8	. . 56.6	73 59.9	11.3	21 43.8	3.8	54.6
U 10	331 26.1	55.6	88 30.2	11.3	21 47.6	3.7	54.6
N 11	346 26.3	54.6	103 00.5	11.3	21 51.3	3.6	54.7
D 12	1 26.5	N 1 53.7	117 30.8	11.2	N21 54.9	3.5	54.7
A 13	16 26.7	52.7	132 01.0	11.2	21 58.4	3.4	54.7
Y 14	31 27.0	51.7	146 31.2	11.1	22 01.8	3.3	54.7
15	46 27.2	. . 50.8	161 01.3	11.1	22 05.1	3.2	54.7
16	61 27.4	49.8	175 31.4	11.0	22 08.3	3.1	54.8
17	76 27.6	48.8	190 01.4	11.0	22 11.4	3.0	54.8
18	91 27.9	N 1 47.9	204 31.4	11.0	N22 14.4	2.9	54.8
19	106 28.1	46.9	219 01.4	10.9	22 17.3	2.7	54.8
20	121 28.3	45.9	233 31.3	10.8	22 20.0	2.7	54.8
21	136 28.5	. . 45.0	248 01.1	10.8	22 22.7	2.5	54.9
22	151 28.7	44.0	262 30.9	10.8	22 25.2	2.5	54.9
23	166 29.0	43.0	277 00.7	10.7	N22 27.7	2.3	54.9
	SD 15.9	d 1.0	SD 14.7		14.8		14.9

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 16	Moonrise 17	Moonrise 18	Moonrise 19
°	h m	h m	h m	h m	h m	h m	h m
N 72	02 21	04 03	05 14	15 32			
N 70	02 49	04 15	05 19	16 40			
68	03 09	04 25	05 22	17 17	17 05		
66	03 25	04 32	05 25	17 43	17 47	17 58	18 29
64	03 38	04 39	05 27	18 03	18 15	18 37	19 16
62	03 49	04 44	05 30	18 20	18 37	19 04	19 46
60	03 58	04 49	05 31	18 33	18 54	19 25	20 09
N 58	04 05	04 53	05 33	18 45	19 09	19 42	20 27
56	04 12	04 57	05 35	18 56	19 22	19 57	20 42
54	04 17	05 00	05 36	19 05	19 33	20 09	20 56
52	04 22	05 03	05 37	19 13	19 43	20 20	21 07
50	04 27	05 06	05 38	19 20	19 52	20 30	21 18
45	04 36	05 11	05 40	19 36	20 10	20 51	21 39
N 40	04 43	05 15	05 42	19 49	20 26	21 08	21 57
35	04 49	05 19	05 44	20 00	20 39	21 22	22 11
30	04 53	05 21	05 45	20 10	20 50	21 35	22 24
20	05 00	05 26	05 48	20 27	21 09	21 56	22 46
N 10	05 04	05 29	05 50	20 41	21 26	22 14	23 05
0	05 07	05 31	05 51	20 55	21 42	22 31	23 22
S 10	05 08	05 32	05 53	21 09	21 58	22 49	23 40
20	05 07	05 33	05 55	21 24	22 15	23 07	23 59
30	05 05	05 32	05 56	21 41	22 35	23 29	24 21
35	05 03	05 32	05 57	21 51	22 47	23 41	24 34
40	05 00	05 31	05 58	22 03	23 00	23 56	24 48
45	04 56	05 30	05 59	22 16	23 16	24 13	00 13
S 50	04 51	05 29	06 01	22 33	23 35	24 34	00 34
52	04 49	05 28	06 01	22 41	23 45	24 45	00 45
54	04 46	05 27	06 02	22 50	23 55	24 56	00 56
56	04 42	05 26	06 03	22 59	24 07	00 07	01 09
58	04 39	05 25	06 04	23 11	24 21	00 21	01 25
S 60	04 34	05 23	06 04	23 24	24 37	00 37	01 43

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 16	Moonset 17	Moonset 18	Moonset 19
°	h m	h m	h m	h m	h m	h m	h m
N 72	18 32	19 43	21 22	13 41			
N 70	18 28	19 31	20 56	12 34			
68	18 25	19 22	20 36	11 58	13 46		
66	18 22	19 15	20 21	11 33	13 05	14 35	15 48
64	18 20	19 08	20 08	11 13	12 37	13 56	15 02
62	18 18	19 03	19 58	10 57	12 16	13 29	14 32
60	18 16	18 58	19 50	10 44	11 59	13 08	14 09
N 58	18 15	18 54	19 42	10 33	11 44	12 51	13 51
56	18 13	18 51	19 36	10 23	11 32	12 37	13 35
54	18 12	18 48	19 30	10 14	11 21	12 25	13 22
52	18 11	18 45	19 25	10 07	11 12	12 14	13 10
50	18 10	18 43	19 21	10 00	11 03	12 04	13 00
45	18 08	18 37	19 12	09 45	10 45	11 44	12 39
N 40	18 06	18 33	19 05	09 33	10 31	11 27	12 21
35	18 05	18 30	19 00	09 22	10 18	11 13	12 07
30	18 03	18 27	18 55	09 13	10 07	11 01	11 54
20	18 01	18 23	18 49	08 58	09 49	10 40	11 32
N 10	17 59	18 20	18 45	08 44	09 33	10 22	11 13
0	17 58	18 19	18 43	08 32	09 18	10 06	10 56
S 10	17 56	18 17	18 42	08 19	09 03	09 49	10 38
20	17 55	18 17	18 42	08 06	08 47	09 31	10 19
30	17 53	18 17	18 45	07 50	08 28	09 11	09 58
35	17 52	18 18	18 47	07 42	08 18	08 59	09 45
40	17 52	18 19	18 50	07 32	08 06	08 45	09 30
45	17 50	18 20	18 54	07 20	07 51	08 29	09 13
S 50	17 49	18 21	18 59	07 05	07 34	08 09	08 51
52	17 49	18 22	19 02	06 59	07 26	07 59	08 41
54	17 48	18 23	19 05	06 52	07 17	07 48	08 29
56	17 47	18 25	19 08	06 43	07 06	07 36	08 16
58	17 47	18 26	19 12	06 34	06 55	07 22	08 01
S 60	17 46	18 27	19 17	06 24	06 41	07 06	07 42

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
16	04 52	05 03	11 55	02 21	14 43	18	85
17	05 13	05 24	11 55	03 06	15 30	19	78
18	05 35	05 46	11 54	03 54	16 19	20	70

UT	ARIES	VENUS −3.9		MARS +1.3		JUPITER −2.8		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
19 00	357 33.4	172 37.9	S 0 46.8	235 12.6	N21 05.0	319 46.4	N13 21.4	160 50.5	S 4 39.6
01	12 35.9	187 37.5	48.1	250 13.5	04.8	334 49.0	21.4	175 52.7	39.7
02	27 38.4	202 37.1	49.4	265 14.3	04.5	349 51.6	21.3	190 54.9	39.8
03	42 40.8	217 36.8	50.7	280 15.2	04.2	4 54.2	21.2	205 57.1	39.9
04	57 43.3	232 36.4	51.9	295 16.1	03.9	19 56.8	21.2	220 59.3	40.1
05	72 45.8	247 36.0	53.2	310 16.9	03.6	34 59.5	21.1	236 01.5	40.2
06	87 48.2	262 35.6	S 0 54.5	325 17.8	N21 03.3	50 02.1	N13 21.1	251 03.7	S 4 40.3
07	102 50.7	277 35.3	55.8	340 18.6	03.0	65 04.7	21.0	266 05.9	40.4
08	117 53.1	292 34.9	57.0	355 19.5	02.7	80 07.3	20.9	281 08.1	40.5
M 09	132 55.6	307 34.5	58.3	10 20.3	02.4	95 09.9	20.9	296 10.3	40.6
O 10	147 58.1	322 34.2	0 59.6	25 21.2	02.1	110 12.6	20.8	311 12.5	40.7
N 11	163 00.5	337 33.8	1 00.9	40 22.0	01.8	125 15.2	20.8	326 14.7	40.9
D 12	178 03.0	352 33.4	S 1 02.1	55 22.9	N21 01.5	140 17.8	N13 20.7	341 16.9	S 4 41.0
A 13	193 05.5	7 33.1	03.4	70 23.7	01.2	155 20.4	20.7	356 19.1	41.1
Y 14	208 07.9	22 32.7	04.7	85 24.6	00.9	170 23.0	20.6	11 21.3	41.2
15	223 10.4	37 32.3	06.0	100 25.5	00.7	185 25.7	20.5	26 23.4	41.3
16	238 12.9	52 32.0	07.2	115 26.3	00.4	200 28.3	20.5	41 25.6	41.4
17	253 15.3	67 31.6	08.5	130 27.2	21 00.1	215 30.9	20.4	56 27.8	41.5
18	268 17.8	82 31.2	S 1 09.8	145 28.0	N20 59.8	230 33.5	N13 20.4	71 30.0	S 4 41.7
19	283 20.2	97 30.9	11.1	160 28.9	59.5	245 36.2	20.3	86 32.2	41.8
20	298 22.7	112 30.5	12.3	175 29.7	59.2	260 38.8	20.3	101 34.4	41.9
21	313 25.2	127 30.1	13.6	190 30.6	58.9	275 41.4	20.2	116 36.6	42.0
22	328 27.6	142 29.7	14.9	205 31.5	58.6	290 44.0	20.1	131 38.8	42.1
23	343 30.1	157 29.4	16.2	220 32.3	58.3	305 46.7	20.1	146 41.0	42.2
20 00	358 32.6	172 29.0	S 1 17.4	235 33.2	N20 58.0	320 49.3	N13 20.0	161 43.2	S 4 42.3
01	13 35.0	187 28.6	18.7	250 34.0	57.7	335 51.9	20.0	176 45.4	42.4
02	28 37.5	202 28.3	20.0	265 34.9	57.4	350 54.5	19.9	191 47.6	42.6
03	43 40.0	217 27.9	21.3	280 35.7	57.1	5 57.2	19.8	206 49.8	42.7
04	58 42.4	232 27.5	22.5	295 36.6	56.8	20 59.8	19.8	221 52.0	42.8
05	73 44.9	247 27.2	23.8	310 37.5	56.5	36 02.4	19.7	236 54.2	42.9
06	88 47.4	262 26.8	S 1 25.1	325 38.3	N20 56.2	51 05.0	N13 19.7	251 56.4	S 4 43.0
07	103 49.8	277 26.4	26.4	340 39.2	55.9	66 07.7	19.6	266 58.6	43.1
T 08	118 52.3	292 26.1	27.6	355 40.0	55.6	81 10.3	19.5	282 00.7	43.2
U 09	133 54.7	307 25.7	28.9	10 40.9	55.3	96 12.9	19.5	297 02.9	43.4
E 10	148 57.2	322 25.3	30.2	25 41.8	55.0	111 15.6	19.4	312 05.1	43.5
S 11	163 59.7	337 24.9	31.5	40 42.6	54.7	126 18.2	19.4	327 07.3	43.6
D 12	179 02.1	352 24.6	S 1 32.7	55 43.5	N20 54.4	141 20.8	N13 19.3	342 09.5	S 4 43.7
A 13	194 04.6	7 24.2	34.0	70 44.3	54.1	156 23.4	19.2	357 11.7	43.8
Y 14	209 07.1	22 23.8	35.3	85 45.2	53.8	171 26.1	19.2	12 13.9	43.9
15	224 09.5	37 23.5	36.6	100 46.1	53.5	186 28.7	19.1	27 16.1	44.0
16	239 12.0	52 23.1	37.8	115 46.9	53.2	201 31.3	19.1	42 18.3	44.2
17	254 14.5	67 22.7	39.1	130 47.8	52.9	216 34.0	19.0	57 20.5	44.3
18	269 16.9	82 22.4	S 1 40.4	145 48.7	N20 52.6	231 36.6	N13 18.9	72 22.7	S 4 44.4
19	284 19.4	97 22.0	41.7	160 49.5	52.3	246 39.2	18.9	87 24.9	44.5
20	299 21.9	112 21.6	42.9	175 50.4	52.0	261 41.9	18.8	102 27.1	44.6
21	314 24.3	127 21.2	44.2	190 51.3	51.7	276 44.5	18.7	117 29.3	44.7
22	329 26.8	142 20.9	45.5	205 52.1	51.4	291 47.1	18.7	132 31.5	44.8
23	344 29.2	157 20.5	46.8	220 53.0	51.1	306 49.8	18.6	147 33.6	45.0
21 00	359 31.7	172 20.1	S 1 48.0	235 53.8	N20 50.8	321 52.4	N13 18.6	162 35.8	S 4 45.1
01	14 34.2	187 19.8	49.3	250 54.7	50.5	336 55.0	18.5	177 38.0	45.2
02	29 36.6	202 19.4	50.6	265 55.6	50.2	351 57.7	18.4	192 40.2	45.3
03	44 39.1	217 19.0	51.9	280 56.4	49.9	7 00.3	18.4	207 42.4	45.4
04	59 41.6	232 18.6	53.1	295 57.3	49.6	22 02.9	18.3	222 44.6	45.5
05	74 44.0	247 18.3	54.4	310 58.2	49.3	37 05.6	18.3	237 46.8	45.6
06	89 46.5	262 17.9	S 1 55.7	325 59.0	N20 49.0	52 08.2	N13 18.2	252 49.0	S 4 45.8
W 07	104 49.0	277 17.5	57.0	340 59.9	48.7	67 10.8	18.1	267 51.2	45.9
E 08	119 51.4	292 17.2	58.2	356 00.8	48.4	82 13.5	18.1	282 53.4	46.0
D 09	134 53.9	307 16.8	1 59.5	11 01.6	48.1	97 16.1	18.0	297 55.6	46.1
N 10	149 56.3	322 16.4	2 00.8	26 02.5	47.8	112 18.7	17.9	312 57.8	46.2
E 11	164 58.8	337 16.1	02.1	41 03.4	47.5	127 21.4	17.9	328 00.0	46.3
S 12	180 01.3	352 15.7	S 2 03.3	56 04.2	N20 47.2	142 24.0	N13 17.8	343 02.2	S 4 46.4
D 13	195 03.7	7 15.3	04.6	71 05.1	46.9	157 26.6	17.8	358 04.3	46.6
A 14	210 06.2	22 14.9	05.9	86 06.0	46.6	172 29.3	17.7	13 06.5	46.7
Y 15	225 08.7	37 14.6	07.1	101 06.8	46.3	187 31.9	17.6	28 08.7	46.8
16	240 11.1	52 14.2	08.4	116 07.7	46.0	202 34.6	17.6	43 10.9	46.9
17	255 13.6	67 13.8	09.7	131 08.6	45.7	217 37.2	17.5	58 13.1	47.0
18	270 16.1	82 13.5	S 2 11.0	146 09.4	N20 45.4	232 39.8	N13 17.4	73 15.3	S 4 47.1
19	285 18.5	97 13.1	12.2	161 10.3	45.1	247 42.5	17.4	88 17.5	47.2
20	300 21.0	112 12.7	13.5	176 11.2	44.8	262 45.1	17.3	103 19.7	47.4
21	315 23.5	127 12.3	14.8	191 12.1	44.5	277 47.8	17.3	118 21.9	47.5
22	330 25.9	142 12.0	16.1	206 12.9	44.2	292 50.4	17.2	133 24.1	47.6
23	345 28.4	157 11.6	17.3	221 13.8	43.8	307 53.0	17.1	148 26.3	47.7
Mer. Pass.	h m 0 05.8	*v* −0.4	*d* 1.3	*v* 0.9	*d* 0.3	*v* 2.6	*d* 0.1	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 19.0	S40 15.2
Achernar	335 27.1	S57 10.4
Acrux	173 11.4	S63 09.9
Adhara	255 13.6	S28 59.1
Aldebaran	290 50.7	N16 32.0
Alioth	166 22.2	N55 53.8
Alkaid	153 00.2	N49 15.4
Al Na'ir	27 44.8	S46 54.1
Alnilam	275 47.6	S 1 11.6
Alphard	217 57.6	S 8 42.5
Alphecca	126 12.2	N26 40.7
Alpheratz	357 44.4	N29 09.5
Altair	62 09.3	N 8 54.2
Ankaa	353 16.4	S42 14.3
Antares	112 27.9	S26 27.5
Arcturus	145 57.1	N19 07.4
Atria	107 31.0	S69 03.1
Avior	234 18.9	S59 32.6
Bellatrix	278 33.3	N 6 21.7
Betelgeuse	271 02.6	N 7 24.6
Canopus	263 56.8	S52 41.9
Capella	280 36.2	N46 00.4
Deneb	49 32.0	N45 19.7
Denebola	182 35.2	N14 30.4
Diphda	348 56.8	S17 55.1
Dubhe	193 53.7	N61 41.2
Elnath	278 14.1	N28 36.9
Eltanin	90 46.7	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.8
Gienah	175 53.9	S17 36.4
Hadar	148 50.2	S60 25.9
Hamal	328 01.9	N23 31.2
Kaus Aust.	83 45.4	S34 22.7
Kochab	137 20.6	N74 06.6
Markab	13 39.2	N15 16.4
Menkar	314 16.1	N 4 08.3
Menkent	148 09.4	S36 25.7
Miaplacidus	221 40.7	S69 45.8
Mirfak	308 41.9	N49 54.1
Nunki	75 59.7	S26 16.8
Peacock	53 20.8	S56 41.8
Pollux	243 29.4	N27 59.7
Procyon	245 01.2	N 5 11.7
Rasalhague	96 07.6	N12 33.3
Regulus	207 45.1	N11 54.6
Rigel	281 13.2	S 8 11.2
Rigil Kent.	139 53.9	S60 53.1
Sabik	102 14.0	S15 44.3
Schedar	349 41.4	N56 36.2
Shaula	96 23.6	S37 06.7
Sirius	258 34.9	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.7	S43 28.7
Vega	80 39.7	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	173 56.4	12 30
Mars	237 00.6	8 17
Jupiter	322 16.7	2 36
Saturn	163 10.6	13 11

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
19 00	181 29.2	N 1 42.1	291 30.4	10.7	N22 30.0	2.3	54.9
01	196 29.4	41.1	306 00.1	10.7	22 32.3	2.1	54.9
02	211 29.6	40.1	320 29.8	10.6	22 34.4	2.0	55.0
03	226 29.9	. . 39.1	334 59.4	10.5	22 36.4	1.9	55.0
04	241 30.1	38.2	349 28.9	10.6	22 38.3	1.8	55.0
05	256 30.3	37.2	3 58.5	10.4	22 40.1	1.7	55.0
06	271 30.5	N 1 36.2	18 27.9	10.5	N22 41.8	1.6	55.0
07	286 30.8	35.3	32 57.4	10.4	22 43.4	1.4	55.1
08	301 31.0	34.3	47 26.8	10.3	22 44.8	1.4	55.1
M 09	316 31.2	. . 33.3	61 56.1	10.4	22 46.2	1.2	55.1
O 10	331 31.4	32.4	76 25.5	10.3	22 47.4	1.1	55.1
N 11	346 31.6	31.4	90 54.8	10.2	22 48.5	1.0	55.2
D 12	1 31.9	N 1 30.4	105 24.0	10.2	N22 49.5	0.9	55.2
A 13	16 32.1	29.5	119 53.2	10.2	22 50.4	0.8	55.2
Y 14	31 32.3	28.5	134 22.4	10.2	22 51.2	0.7	55.2
15	46 32.5	. . 27.5	148 51.6	10.1	22 51.9	0.5	55.3
16	61 32.8	26.5	163 20.7	10.0	22 52.4	0.4	55.3
17	76 33.0	25.6	177 49.7	10.1	22 52.8	0.3	55.3
18	91 33.2	N 1 24.6	192 18.8	10.0	N22 53.1	0.2	55.3
19	106 33.4	23.6	206 47.8	10.0	22 53.3	0.1	55.4
20	121 33.7	22.7	221 16.8	9.9	22 53.4	0.0	55.4
21	136 33.9	. . 21.7	235 45.7	9.9	22 53.4	0.2	55.4
22	151 34.1	20.7	250 14.6	9.9	22 53.2	0.2	55.5
23	166 34.3	19.8	264 43.5	9.9	22 53.0	0.4	55.5
20 00	181 34.5	N 1 18.8	279 12.4	9.8	N22 52.6	0.5	55.5
01	196 34.8	17.8	293 41.2	9.8	22 52.1	0.6	55.5
02	211 35.0	16.8	308 10.0	9.7	22 51.5	0.8	55.6
03	226 35.2	. . 15.9	322 38.7	9.8	22 50.7	0.8	55.6
04	241 35.4	14.9	337 07.5	9.7	22 49.9	1.0	55.6
05	256 35.7	13.9	351 36.2	9.7	22 48.9	1.1	55.7
06	271 35.9	N 1 13.0	6 04.9	9.6	N22 47.8	1.3	55.7
07	286 36.1	12.0	20 33.5	9.7	22 46.5	1.3	55.7
T 08	301 36.3	11.0	35 02.2	9.6	22 45.2	1.5	55.7
U 09	316 36.5	. . 10.1	49 30.8	9.6	22 43.7	1.5	55.8
E 10	331 36.8	09.1	63 59.4	9.5	22 42.2	1.7	55.8
S 11	346 37.0	08.1	78 27.9	9.6	22 40.5	1.9	55.8
D 12	1 37.2	N 1 07.1	92 56.5	9.5	N22 38.6	1.9	55.9
A 13	16 37.4	06.2	107 25.0	9.5	22 36.7	2.1	55.9
Y 14	31 37.7	05.2	121 53.5	9.5	22 34.6	2.2	55.9
15	46 37.9	. . 04.2	136 22.0	9.4	22 32.4	2.3	56.0
16	61 38.1	03.3	150 50.4	9.5	22 30.1	2.4	56.0
17	76 38.3	02.3	165 18.9	9.4	22 27.7	2.6	56.0
18	91 38.5	N 1 01.3	179 47.3	9.4	N22 25.1	2.6	56.1
19	106 38.8	1 00.4	194 15.7	9.4	22 22.5	2.8	56.1
20	121 39.0	0 59.4	208 44.1	9.3	22 19.7	3.0	56.1
21	136 39.2	. . 58.4	223 12.4	9.4	22 16.7	3.0	56.2
22	151 39.4	57.4	237 40.8	9.3	22 13.7	3.2	56.2
23	166 39.7	56.5	252 09.1	9.3	22 10.5	3.2	56.2
21 00	181 39.9	N 0 55.5	266 37.4	9.3	N22 07.3	3.5	56.3
01	196 40.1	54.5	281 05.7	9.3	22 03.8	3.5	56.3
02	211 40.3	53.6	295 34.0	9.3	22 00.3	3.6	56.3
03	226 40.5	. . 52.6	310 02.3	9.3	21 56.7	3.8	56.4
04	241 40.8	51.6	324 30.6	9.2	21 52.9	3.9	56.4
05	256 41.0	50.6	338 58.8	9.3	21 49.0	4.0	56.4
06	271 41.2	N 0 49.7	353 27.1	9.2	N21 45.0	4.2	56.5
W 07	286 41.4	48.7	7 55.3	9.2	21 40.8	4.2	56.5
E 08	301 41.7	47.7	22 23.5	9.2	21 36.6	4.4	56.5
D 09	316 41.9	. . 46.8	36 51.7	9.2	21 32.2	4.5	56.6
N 10	331 42.1	45.8	51 19.9	9.2	21 27.7	4.7	56.6
E 11	346 42.3	44.8	65 48.1	9.2	21 23.0	4.7	56.6
S 12	1 42.5	N 0 43.8	80 16.3	9.2	N21 18.3	4.9	56.7
D 13	16 42.8	42.9	94 44.5	9.2	21 13.4	5.0	56.7
A 14	31 43.0	41.9	109 12.7	9.2	21 08.4	5.1	56.7
Y 15	46 43.2	. . 40.9	123 40.9	9.1	21 03.3	5.3	56.8
16	61 43.4	40.0	138 09.0	9.2	20 58.0	5.3	56.8
17	76 43.6	39.0	152 37.2	9.1	20 52.7	5.5	56.9
18	91 43.9	N 0 38.0	167 05.3	9.2	N20 47.2	5.6	56.9
19	106 44.1	37.0	181 33.5	9.1	20 41.6	5.7	56.9
20	121 44.3	36.1	196 01.6	9.2	20 35.9	5.9	57.0
21	136 44.5	. . 35.1	210 29.8	9.1	20 30.0	5.9	57.0
22	151 44.7	34.1	224 57.9	9.1	20 24.1	6.1	57.0
23	166 45.0	33.1	239 26.0	9.2	N20 18.0	6.2	57.1
	SD 16.0	d 1.0	SD 15.0		15.2		15.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 19	Moonrise 20	Moonrise 21	Moonrise 22
°	h m	h m	h m	h m	h m	h m	h m
N 72	02 42	04 18	05 28	▭	▭	▭	20 46
N 70	03 06	04 28	05 30	▭	▭	▭	21 56
68	03 23	04 36	05 33	▭	▭	20 28	22 32
66	03 37	04 42	05 34	18 29	19 38	21 13	22 58
64	03 49	04 48	05 36	19 16	20 19	21 42	23 18
62	03 58	04 53	05 37	19 46	20 47	22 04	23 34
60	04 06	04 57	05 38	20 09	21 08	22 22	23 47
N 58	04 12	05 00	05 39	20 27	21 26	22 37	23 58
56	04 18	05 03	05 40	20 42	21 40	22 50	24 08
54	04 23	05 06	05 41	20 56	21 53	23 01	24 17
52	04 28	05 08	05 42	21 07	22 04	23 11	24 25
50	04 32	05 10	05 43	21 18	22 14	23 19	24 32
45	04 40	05 15	05 44	21 39	22 35	23 38	24 47
N 40	04 46	05 18	05 45	21 57	22 52	23 53	24 59
35	04 51	05 21	05 46	22 11	23 06	24 06	00 06
30	04 55	05 23	05 47	22 24	23 18	24 17	00 17
20	05 01	05 26	05 48	22 46	23 39	24 36	00 36
N 10	05 04	05 28	05 49	23 05	23 57	24 52	00 52
0	05 06	05 30	05 50	23 22	24 15	00 15	01 07
S 10	05 06	05 30	05 51	23 40	24 32	00 32	01 23
20	05 04	05 30	05 52	23 59	24 50	00 50	01 39
30	05 01	05 29	05 53	24 21	00 21	01 11	01 58
35	04 58	05 28	05 53	24 34	00 34	01 23	02 09
40	04 55	05 26	05 53	24 48	00 48	01 37	02 21
45	04 50	05 25	05 54	00 13	01 06	01 54	02 36
S 50	04 44	05 22	05 54	00 34	01 28	02 14	02 54
52	04 41	05 21	05 54	00 45	01 38	02 24	03 02
54	04 38	05 19	05 55	00 56	01 50	02 35	03 11
56	04 34	05 18	05 55	01 09	02 03	02 47	03 22
58	04 30	05 16	05 55	01 25	02 19	03 02	03 34
S 60	04 25	05 14	05 55	01 43	02 38	03 19	03 48

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 19	Moonset 20	Moonset 21	Moonset 22
°	h m	h m	h m	h m	h m	h m	h m
N 72	18 17	19 26	20 59	▭	▭	▭	19 03
N 70	18 14	19 16	20 37	▭	▭	▭	17 52
68	18 12	19 09	20 20	▭	▭	17 28	17 15
66	18 11	19 02	20 07	15 48	16 28	16 43	16 48
64	18 09	18 57	19 56	15 02	15 47	16 13	16 27
62	18 08	18 53	19 47	14 32	15 19	15 50	16 11
60	18 07	18 49	19 39	14 09	14 57	15 32	15 57
N 58	18 06	18 46	19 33	13 51	14 39	15 17	15 44
56	18 05	18 43	19 27	13 35	14 24	15 03	15 34
54	18 05	18 40	19 22	13 22	14 11	14 52	15 25
52	18 04	18 38	19 18	13 10	14 00	14 42	15 16
50	18 03	18 36	19 14	13 00	13 50	14 33	15 09
45	18 02	18 32	19 06	12 39	13 29	14 14	14 53
N 40	18 01	18 28	19 00	12 21	13 12	13 58	14 40
35	18 00	18 26	18 55	12 07	12 57	13 45	14 29
30	18 00	18 24	18 51	11 54	12 45	13 33	14 19
20	17 58	18 20	18 46	11 32	12 23	13 13	14 02
N 10	17 58	18 19	18 43	11 13	12 05	12 56	13 47
0	17 57	18 17	18 41	10 56	11 47	12 40	13 33
S 10	17 56	18 17	18 41	10 38	11 30	12 23	13 18
20	17 55	18 17	18 43	10 19	11 11	12 06	13 03
30	17 55	18 19	18 47	09 58	10 49	11 46	12 46
35	17 55	18 20	18 49	09 45	10 37	11 34	12 36
40	17 54	18 21	18 53	09 30	10 22	11 20	12 24
45	17 54	18 23	18 58	09 13	10 05	11 04	12 10
S 50	17 54	18 26	19 04	08 51	09 43	10 44	11 53
52	17 54	18 27	19 07	08 41	09 33	10 34	11 45
54	17 53	18 29	19 10	08 29	09 21	10 24	11 36
56	17 53	18 30	19 14	08 16	09 08	10 11	11 26
58	17 53	18 32	19 19	08 01	08 52	09 57	11 14
S 60	17 53	18 35	19 24	07 42	08 33	09 41	11 01

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
19	05 56	06 07	11 54	04 44	17 09	21	61
20	06 18	06 28	11 54	05 35	18 01	22	51
21	06 39	06 50	11 53	06 27	18 54	23	41

UT	ARIES	VENUS −3.9			MARS +1.3			JUPITER −2.8			SATURN +0.8			STARS		
	GHA	GHA		Dec	GHA		Dec	GHA		Dec	GHA		Dec	Name	SHA	Dec
d h	° ′	° ′		° ′	° ′		° ′	° ′		° ′	° ′		° ′		° ′	° ′
22 00	0 30.8	172 11.2	S	2 18.6	236 14.7	N	20 43.5	322 55.7	N	13 17.1	163 28.5	S	4 47.8	Acamar	315 18.9	S40 15.2
01	15 33.3	187 10.8		19.9	251 15.5		43.2	337 58.3		17.0	178 30.6		47.9	Achernar	335 27.1	S57 10.4
02	30 35.8	202 10.5		21.2	266 16.4		42.9	353 01.0		16.9	193 32.8		48.0	Acrux	173 11.4	S63 09.9
03	45 38.2	217 10.1	. .	22.4	281 17.3	. .	42.6	8 03.6	. .	16.9	208 35.0	. .	48.2	Adhara	255 13.6	S28 59.1
04	60 40.7	232 09.7		23.7	296 18.2		42.3	23 06.2		16.8	223 37.2		48.3	Aldebaran	290 50.7	N16 32.0
05	75 43.2	247 09.4		25.0	311 19.0		42.0	38 08.9		16.7	238 39.4		48.4			
06	90 45.6	262 09.0	S	2 26.3	326 19.9	N	20 41.7	53 11.5	N	13 16.7	253 41.6	S	4 48.5	Alioth	166 22.2	N55 53.8
07	105 48.1	277 08.6		27.5	341 20.8		41.4	68 14.2		16.6	268 43.8		48.6	Alkaid	153 00.2	N49 15.4
T 08	120 50.6	292 08.2		28.8	356 21.6		41.1	83 16.8		16.5	283 46.0		48.7	Al Na'ir	27 44.8	S46 54.1
H 09	135 53.0	307 07.9	. .	30.1	11 22.5	. .	40.8	98 19.4	. .	16.5	298 48.2	. .	48.8	Alnilam	275 47.6	S 1 11.6
U 10	150 55.5	322 07.5		31.3	26 23.4		40.5	113 22.1		16.4	313 50.4		49.0	Alphard	217 57.5	S 8 42.5
R 11	165 58.0	337 07.1		32.6	41 24.3		40.2	128 24.7		16.4	328 52.6		49.1			
S 12	181 00.4	352 06.7	S	2 33.9	56 25.1	N	20 39.9	143 27.4	N	13 16.3	343 54.8	S	4 49.2	Alphecca	126 12.2	N26 40.7
D 13	196 02.9	7 06.4		35.2	71 26.0		39.5	158 30.0		16.2	358 56.9		49.3	Alpheratz	357 44.4	N29 09.5
A 14	211 05.3	22 06.0		36.4	86 26.9		39.2	173 32.7		16.2	13 59.1		49.4	Altair	62 09.3	N 8 54.2
Y 15	226 07.8	37 05.6	. .	37.7	101 27.8	. .	38.9	188 35.3	. .	16.1	29 01.3	. .	49.5	Ankaa	353 16.4	S42 14.3
16	241 10.3	52 05.3		39.0	116 28.6		38.6	203 38.0		16.0	44 03.5		49.6	Antares	112 27.9	S26 27.5
17	256 12.7	67 04.9		40.3	131 29.5		38.3	218 40.6		16.0	59 05.7		49.8			
18	271 15.2	82 04.5	S	2 41.5	146 30.4	N	20 38.0	233 43.2	N	13 15.9	74 07.9	S	4 49.9	Arcturus	145 57.1	N19 07.4
19	286 17.7	97 04.1		42.8	161 31.3		37.7	248 45.9		15.8	89 10.1		50.0	Atria	107 31.0	S69 03.1
20	301 20.1	112 03.8		44.1	176 32.1		37.4	263 48.5		15.8	104 12.3		50.1	Avior	234 18.9	S59 32.6
21	316 22.6	127 03.4	. .	45.3	191 33.0	. .	37.1	278 51.2	. .	15.7	119 14.5	. .	50.2	Bellatrix	278 33.3	N 6 21.7
22	331 25.1	142 03.0		46.6	206 33.9		36.8	293 53.8		15.6	134 16.7		50.3	Betelgeuse	271 02.6	N 7 24.6
23	346 27.5	157 02.6		47.9	221 34.8		36.5	308 56.5		15.6	149 18.9		50.4			
23 00	1 30.0	172 02.3	S	2 49.2	236 35.6	N	20 36.1	323 59.1	N	13 15.5	164 21.1	S	4 50.6	Canopus	263 56.7	S52 41.8
01	16 32.5	187 01.9		50.4	251 36.5		35.8	339 01.8		15.4	179 23.2		50.7	Capella	280 36.2	N46 00.4
02	31 34.9	202 01.5		51.7	266 37.4		35.5	354 04.4		15.4	194 25.4		50.8	Deneb	49 32.1	N45 19.7
03	46 37.4	217 01.1	. .	53.0	281 38.3	. .	35.2	9 07.1	. .	15.3	209 27.6	. .	50.9	Denebola	182 35.2	N14 30.4
04	61 39.8	232 00.8		54.3	296 39.2		34.9	24 09.7		15.2	224 29.8		51.0	Diphda	348 56.8	S17 55.1
05	76 42.3	247 00.4		55.5	311 40.0		34.6	39 12.4		15.2	239 32.0		51.1			
06	91 44.8	262 00.0	S	2 56.8	326 40.9	N	20 34.3	54 15.0	N	13 15.1	254 34.2	S	4 51.2	Dubhe	193 53.7	N61 41.1
07	106 47.2	276 59.6		58.1	341 41.8		34.0	69 17.7		15.0	269 36.4		51.4	Elnath	278 14.1	N28 36.9
08	121 49.7	291 59.3		2 59.3	356 42.7		33.7	84 20.3		15.0	284 38.6		51.5	Eltanin	90 46.7	N51 29.6
F 09	136 52.2	306 58.9		3 00.6	11 43.6	. .	33.3	99 23.0	. .	14.9	299 40.8	. .	51.6	Enif	33 48.1	N 9 56.0
R 10	151 54.6	321 58.5		01.9	26 44.4		33.0	114 25.6		14.8	314 43.0		51.7	Fomalhaut	15 24.9	S29 33.4
I 11	166 57.1	336 58.1		03.2	41 45.3		32.7	129 28.3		14.8	329 45.2		51.8			
D 12	181 59.6	351 57.8	S	3 04.4	56 46.2	N	20 32.4	144 30.9	N	13 14.7	344 47.3	S	4 51.9	Gacrux	172 02.9	S57 10.8
A 13	197 02.0	6 57.4		05.7	71 47.1		32.1	159 33.6		14.6	359 49.5		52.0	Gienah	175 53.9	S17 36.4
Y 14	212 04.5	21 57.0		07.0	86 48.0		31.8	174 36.2		14.6	14 51.7		52.2	Hadar	148 50.2	S60 25.9
15	227 06.9	36 56.6	. .	08.2	101 48.8	. .	31.5	189 38.9	. .	14.5	29 53.9	. .	52.3	Hamal	328 01.9	N23 31.2
16	242 09.4	51 56.3		09.5	116 49.7		31.2	204 41.5		14.4	44 56.1		52.4	Kaus Aust.	83 45.4	S34 22.7
17	257 11.9	66 55.9		10.8	131 50.6		30.8	219 44.2		14.4	59 58.3		52.5			
18	272 14.3	81 55.5	S	3 12.1	146 51.5	N	20 30.5	234 46.8	N	13 14.3	75 00.5	S	4 52.6	Kochab	137 20.7	N74 06.6
19	287 16.8	96 55.1		13.3	161 52.4		30.2	249 49.5		14.2	90 02.7		52.7	Markab	13 39.2	N15 16.4
20	302 19.3	111 54.7		14.6	176 53.2		29.9	264 52.1		14.2	105 04.9		52.8	Menkar	314 16.1	N 4 08.3
21	317 21.7	126 54.4	. .	15.9	191 54.1	. .	29.6	279 54.8	. .	14.1	120 07.1	. .	53.0	Menkent	148 09.4	S36 25.7
22	332 24.2	141 54.0		17.1	206 55.0		29.3	294 57.5		14.0	135 09.2		53.1	Miaplacidus	221 40.7	S69 45.8
23	347 26.7	156 53.6		18.4	221 55.9		29.0	310 00.1		14.0	150 11.4		53.2			
24 00	2 29.1	171 53.2	S	3 19.7	236 56.8	N	20 28.6	325 02.8	N	13 13.9	165 13.6	S	4 53.3	Mirfak	308 41.8	N49 54.1
01	17 31.6	186 52.9		20.9	251 57.7		28.3	340 05.4		13.8	180 15.8		53.4	Nunki	75 59.7	S26 16.8
02	32 34.1	201 52.5		22.2	266 58.5		28.0	355 08.1		13.8	195 18.0		53.5	Peacock	53 20.8	S56 41.8
03	47 36.5	216 52.1	. .	23.5	281 59.4	. .	27.7	10 10.7	. .	13.7	210 20.2	. .	53.6	Pollux	243 29.4	N27 59.7
04	62 39.0	231 51.7		24.8	297 00.3		27.4	25 13.4		13.6	225 22.4		53.8	Procyon	245 01.1	N 5 11.7
05	77 41.4	246 51.4		26.0	312 01.2		27.1	40 16.0		13.6	240 24.6		53.9			
06	92 43.9	261 51.0	S	3 27.3	327 02.1	N	20 26.8	55 18.7	N	13 13.5	255 26.8	S	4 54.0	Rasalhague	96 07.6	N12 33.3
07	107 46.4	276 50.6		28.6	342 03.0		26.4	70 21.4		13.4	270 29.0		54.1	Regulus	207 45.1	N11 54.6
S 08	122 48.8	291 50.2		29.8	357 03.9		26.1	85 24.0		13.3	285 31.1		54.2	Rigel	281 13.2	S 8 11.2
A 09	137 51.3	306 49.8	. .	31.1	12 04.7	. .	25.8	100 26.7	. .	13.3	300 33.3	. .	54.3	Rigil Kent.	139 54.0	S60 53.1
T 10	152 53.8	321 49.5		32.4	27 05.6		25.5	115 29.3		13.2	315 35.5		54.5	Sabik	102 14.0	S15 44.3
U 11	167 56.2	336 49.1		33.6	42 06.5		25.2	130 32.0		13.1	330 37.7		54.6			
R 12	182 58.7	351 48.7	S	3 34.9	57 07.4	N	20 24.9	145 34.6	N	13 13.1	345 39.9	S	4 54.7	Schedar	349 41.4	N56 36.2
D 13	198 01.2	6 48.3		36.2	72 08.3		24.5	160 37.3		13.0	0 42.1		54.8	Shaula	96 23.6	S37 06.7
A 14	213 03.6	21 47.9		37.4	87 09.2		24.2	175 40.0		12.9	15 44.3		54.9	Sirius	258 34.8	S16 43.8
Y 15	228 06.1	36 47.6	. .	38.7	102 10.1	. .	23.9	190 42.6	. .	12.9	30 46.5	. .	55.0	Spica	158 32.8	S11 13.3
16	243 08.6	51 47.2		40.0	117 10.9		23.6	205 45.3		12.8	45 48.7		55.1	Suhail	222 53.7	S43 28.7
17	258 11.0	66 46.8		41.3	132 11.8		23.3	220 47.9		12.7	60 50.8		55.3			
18	273 13.5	81 46.4	S	3 42.5	147 12.7	N	20 22.9	235 50.6	N	13 12.7	75 53.0	S	4 55.4	Vega	80 39.7	N38 48.0
19	288 15.9	96 46.1		43.8	162 13.6		22.6	250 53.3		12.6	90 55.2		55.5	Zuben'ubi	137 07.0	S16 05.4
20	303 18.4	111 45.7		45.1	177 14.5		22.3	265 55.9		12.5	105 57.4		55.6		SHA	Mer. Pass.
21	318 20.9	126 45.3	. .	46.3	192 15.4	. .	22.0	280 58.6	. .	12.4	120 59.6	. .	55.7		° ′	h m
22	333 23.3	141 44.9		47.6	207 16.3		21.7	296 01.2		12.4	136 01.8		55.8	Venus	170 32.3	12 32
23	348 25.8	156 44.5		48.9	222 17.2		21.4	311 03.9		12.3	151 04.0		55.9	Mars	235 05.7	8 13
	h m													Jupiter	322 29.1	2 24
Mer. Pass.	23 50.1	v −0.4		d 1.3	v 0.9		d 0.3	v 2.7		d 0.1	v 2.2		d 0.1	Saturn	162 51.1	13 01

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
22 00	181 45.2	N 0 32.2	253 54.2	9.1	N20 11.8	6.4	57.1
01	196 45.4	31.2	268 22.3	9.1	20 05.4	6.4	57.2
02	211 45.6	30.2	282 50.4	9.2	19 59.0	6.6	57.2
03	226 45.9	29.3	297 18.6	9.1	19 52.4	6.6	57.2
04	241 46.1	28.3	311 46.7	9.1	19 45.8	6.8	57.3
05	256 46.3	27.3	326 14.8	9.2	19 39.0	7.0	57.3
06	271 46.5	N 0 26.3	340 43.0	9.1	N19 32.0	7.0	57.3
07	286 46.7	25.4	355 11.1	9.1	19 25.0	7.1	57.4
08	301 47.0	24.4	9 39.2	9.2	19 17.9	7.3	57.4
09	316 47.2	23.4	24 07.4	9.1	19 10.6	7.4	57.5
10	331 47.4	22.4	38 35.5	9.2	19 03.2	7.5	57.5
11	346 47.6	21.5	53 03.7	9.1	18 55.7	7.6	57.5
12	1 47.8	N 0 20.5	67 31.8	9.2	N18 48.1	7.8	57.6
13	16 48.1	19.5	82 00.0	9.1	18 40.3	7.8	57.6
14	31 48.3	18.6	96 28.1	9.2	18 32.5	8.0	57.7
15	46 48.5	17.6	110 56.3	9.1	18 24.5	8.0	57.7
16	61 48.7	16.6	125 24.4	9.2	18 16.5	8.2	57.7
17	76 48.9	15.6	139 52.6	9.2	18 08.3	8.3	57.8
18	91 49.2	N 0 14.7	154 20.8	9.2	N18 00.0	8.5	57.8
19	106 49.4	13.7	168 49.0	9.1	17 51.5	8.5	57.9
20	121 49.6	12.7	183 17.1	9.2	17 43.0	8.6	57.9
21	136 49.8	11.7	197 45.3	9.2	17 34.4	8.8	57.9
22	151 50.0	10.8	212 13.5	9.2	17 25.6	8.8	58.0
23	166 50.3	09.8	226 41.7	9.2	17 16.8	9.0	58.0
23 00	181 50.5	N 0 08.8	241 09.9	9.2	N17 07.8	9.1	58.1
01	196 50.7	07.9	255 38.1	9.2	16 58.7	9.2	58.1
02	211 50.9	06.9	270 06.3	9.2	16 49.5	9.3	58.1
03	226 51.1	05.9	284 34.5	9.3	16 40.2	9.4	58.2
04	241 51.4	04.9	299 02.8	9.2	16 30.8	9.5	58.2
05	256 51.6	04.0	313 31.0	9.2	16 21.3	9.6	58.3
06	271 51.8	N 0 03.0	327 59.2	9.3	N16 11.7	9.7	58.3
07	286 52.0	02.0	342 27.5	9.2	16 02.0	9.8	58.3
08	301 52.2	01.0	356 55.7	9.3	15 52.2	10.0	58.4
09	316 52.4	N 00.1	11 24.0	9.2	15 42.2	10.0	58.4
10	331 52.7	S 00.9	25 52.2	9.3	15 32.2	10.1	58.5
11	346 52.9	01.9	40 20.5	9.3	15 22.1	10.2	58.5
12	1 53.1	S 0 02.9	54 48.8	9.3	N15 11.9	10.4	58.5
13	16 53.3	03.8	69 17.1	9.2	15 01.5	10.4	58.6
14	31 53.5	04.8	83 45.3	9.3	14 51.1	10.5	58.6
15	46 53.8	05.8	98 13.6	9.3	14 40.6	10.7	58.7
16	61 54.0	06.7	112 41.9	9.3	14 29.9	10.7	58.7
17	76 54.2	07.7	127 10.2	9.3	14 19.2	10.8	58.7
18	91 54.4	S 0 08.7	141 38.5	9.3	N14 08.4	11.0	58.8
19	106 54.6	09.7	156 06.8	9.4	13 57.4	11.0	58.8
20	121 54.9	10.6	170 35.2	9.3	13 46.4	11.1	58.9
21	136 55.1	11.6	185 03.5	9.3	13 35.3	11.2	58.9
22	151 55.3	12.6	199 31.8	9.3	13 24.1	11.3	58.9
23	166 55.5	13.6	214 00.1	9.4	13 12.8	11.4	59.0
24 00	181 55.7	S 0 14.5	228 28.5	9.3	N13 01.4	11.4	59.0
01	196 55.9	15.5	242 56.8	9.4	12 50.0	11.6	59.1
02	211 56.2	16.5	257 25.2	9.3	12 38.4	11.7	59.1
03	226 56.4	17.5	271 53.5	9.4	12 26.7	11.7	59.1
04	241 56.6	18.4	286 21.9	9.3	12 15.0	11.8	59.2
05	256 56.8	19.4	300 50.2	9.4	12 03.2	11.9	59.2
06	271 57.0	S 0 20.4	315 18.6	9.4	N11 51.3	12.0	59.3
07	286 57.3	21.3	329 47.0	9.3	11 39.3	12.1	59.3
08	301 57.5	22.3	344 15.3	9.4	11 27.2	12.2	59.3
09	316 57.7	23.3	358 43.7	9.4	11 15.0	12.2	59.4
10	331 57.9	24.3	13 12.1	9.3	11 02.8	12.3	59.4
11	346 58.1	25.2	27 40.4	9.4	10 50.5	12.4	59.4
12	1 58.3	S 0 26.2	42 08.8	9.4	N10 38.1	12.5	59.5
13	16 58.6	27.2	56 37.2	9.3	10 25.6	12.6	59.5
14	31 58.8	28.2	71 05.5	9.4	10 13.0	12.6	59.6
15	46 59.0	29.1	85 33.9	9.4	10 00.4	12.7	59.6
16	61 59.2	30.1	100 02.3	9.4	9 47.7	12.8	59.6
17	76 59.4	31.1	114 30.7	9.3	9 34.9	12.8	59.7
18	91 59.6	S 0 32.1	128 59.0	9.4	N 9 22.1	12.9	59.7
19	106 59.9	33.0	143 27.4	9.4	9 09.2	13.0	59.7
20	122 00.1	34.0	157 55.8	9.3	8 56.2	13.1	59.8
21	137 00.3	35.0	172 24.1	9.4	8 43.1	13.1	59.8
22	152 00.5	36.0	186 52.5	9.3	8 30.0	13.2	59.8
23	167 00.7	36.9	201 20.8	9.4	N 8 16.8	13.3	59.9
	SD 16.0	d 1.0	SD	15.7	16.0		16.2

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 22	Moonrise 23	Moonrise 24	Moonrise 25
°	h m	h m	h m	h m	h m	h m	h m
N 72	03 02	04 33	05 41	20 46	23 46	26 07	02 07
N 70	03 22	04 41	05 42	21 56	24 12	00 12	02 18
68	03 37	04 47	05 43	22 32	24 31	00 31	02 28
66	03 49	04 52	05 44	22 58	24 46	00 46	02 35
64	03 59	04 57	05 45	23 18	24 58	00 58	02 42
62	04 07	05 01	05 45	23 34	25 09	01 09	02 47
60	04 14	05 04	05 46	23 47	25 18	01 18	02 52
N 58	04 20	05 07	05 46	23 58	25 25	01 25	02 56
56	04 25	05 09	05 46	24 08	00 08	01 32	03 00
54	04 29	05 11	05 47	24 17	00 17	01 38	03 03
52	04 33	05 13	05 47	24 25	00 25	01 44	03 06
50	04 37	05 15	05 47	24 32	00 32	01 49	03 09
45	04 44	05 18	05 48	24 47	00 47	01 59	03 15
N 40	04 49	05 21	05 48	24 59	00 59	02 08	03 20
35	04 54	05 23	05 48	00 06	01 09	02 16	03 24
30	04 57	05 25	05 49	00 17	01 18	02 22	03 28
20	05 01	05 27	05 49	00 36	01 34	02 34	03 34
N 10	05 04	05 28	05 49	00 52	01 47	02 44	03 40
0	05 05	05 29	05 49	01 07	02 00	02 53	03 45
S 10	05 04	05 28	05 49	01 23	02 13	03 02	03 51
20	05 02	05 27	05 49	01 39	02 26	03 12	03 56
30	04 57	05 25	05 49	01 58	02 42	03 23	04 03
35	04 54	05 23	05 49	02 09	02 51	03 29	04 06
40	04 50	05 21	05 48	02 21	03 01	03 37	04 10
45	04 44	05 19	05 48	02 36	03 13	03 45	04 15
S 50	04 37	05 15	05 48	02 54	03 27	03 55	04 21
52	04 34	05 14	05 47	03 02	03 34	04 00	04 24
54	04 30	05 12	05 47	03 11	03 41	04 05	04 26
56	04 26	05 10	05 47	03 22	03 49	04 11	04 30
58	04 21	05 07	05 47	03 34	03 58	04 17	04 33
S 60	04 15	05 05	05 46	03 48	04 09	04 24	04 37

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 22	Moonset 23	Moonset 24	Moonset 25
°	h m	h m	h m	h m	h m	h m	h m
N 72	18 01	19 09	20 38	19 03	17 54	17 24	17 02
N 70	18 01	19 02	20 20	17 52	17 27	17 10	16 57
68	18 00	18 56	20 05	17 15	17 06	16 59	16 52
66	17 59	18 50	19 53	16 48	16 49	16 49	16 49
64	17 59	18 46	19 44	16 27	16 36	16 41	16 45
62	17 58	18 43	19 36	16 11	16 24	16 34	16 43
60	17 58	18 40	19 29	15 57	16 14	16 28	16 40
N 58	17 58	18 37	19 24	15 44	16 06	16 23	16 38
56	17 57	18 35	19 19	15 34	15 58	16 18	16 36
54	17 57	18 32	19 14	15 25	15 51	16 14	16 34
52	17 57	18 31	19 10	15 16	15 45	16 10	16 33
50	17 57	18 29	19 07	15 09	15 40	16 06	16 31
45	17 57	18 26	19 00	14 53	15 28	15 59	16 28
N 40	17 56	18 23	18 55	14 40	15 18	15 52	16 25
35	17 56	18 21	18 51	14 29	15 09	15 47	16 23
30	17 56	18 20	18 48	14 19	15 01	15 42	16 20
20	17 56	18 18	18 43	14 02	14 48	15 33	16 17
N 10	17 56	18 17	18 41	13 47	14 36	15 25	16 13
0	17 56	18 16	18 40	13 33	14 25	15 18	16 10
S 10	17 56	18 17	18 41	13 18	14 14	15 10	16 07
20	17 56	18 18	18 44	13 03	14 02	15 02	16 04
30	17 57	18 20	18 48	12 46	13 49	14 53	16 00
35	17 57	18 22	18 52	12 36	13 41	14 48	15 57
40	17 57	18 24	18 56	12 24	13 31	14 42	15 55
45	17 58	18 27	19 01	12 10	13 21	14 35	15 52
S 50	17 58	18 31	19 09	11 53	13 08	14 26	15 48
52	17 59	18 32	19 12	11 45	13 02	14 22	15 46
54	17 59	18 34	19 16	11 36	12 55	14 18	15 44
56	17 59	18 36	19 21	11 26	12 47	14 13	15 42
58	18 00	18 39	19 26	11 14	12 39	14 08	15 40
S 60	18 00	18 42	19 32	11 01	12 29	14 02	15 37

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
22	07 00	07 11	11 53	07 20	19 46	24	31
23	07 21	07 32	11 52	08 13	20 39	25	21
24	07 42	07 53	11 52	09 05	21 32	26	13

UT	ARIES	VENUS −3.9		MARS +1.3		JUPITER −2.8		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
25 00	3 28.3	171 44.2	S 3 50.1	237 18.1	N20 21.0	326 06.6	N13 12.2	166 06.2	S 4 56.1
01	18 30.7	186 43.8	51.4	252 18.9	20.7	341 09.2	12.2	181 08.4	56.2
02	33 33.2	201 43.4	52.7	267 19.8	20.4	356 11.9	12.1	196 10.5	56.3
03	48 35.7	216 43.0	53.9	282 20.7	20.1	11 14.6	12.0	211 12.7	56.4
04	63 38.1	231 42.6	55.2	297 21.6	19.8	26 17.2	11.9	226 14.9	56.5
05	78 40.6	246 42.2	56.5	312 22.5	19.4	41 19.9	11.9	241 17.1	56.6
06	93 43.0	261 41.9	S 3 57.7	327 23.4	N20 19.1	56 22.5	N13 11.8	256 19.3	S 4 56.7
07	108 45.5	276 41.5	3 59.0	342 24.3	18.8	71 25.2	11.7	271 21.5	56.9
08	123 48.0	291 41.1	4 00.3	357 25.2	18.5	86 27.9	11.7	286 23.7	57.0
S 09	138 50.4	306 40.7	01.5	12 26.1	18.2	101 30.5	11.6	301 25.9	57.1
U 10	153 52.9	321 40.3	02.8	27 27.0	17.8	116 33.2	11.5	316 28.1	57.2
N 11	168 55.4	336 40.0	04.1	42 27.9	17.5	131 35.9	11.4	331 30.2	57.3
D 12	183 57.8	351 39.6	S 4 05.3	57 28.8	N20 17.2	146 38.5	N13 11.4	346 32.4	S 4 57.4
A 13	199 00.3	6 39.2	06.6	72 29.7	16.9	161 41.2	11.3	1 34.6	57.6
Y 14	214 02.8	21 38.8	07.9	87 30.5	16.5	176 43.9	11.2	16 36.8	57.7
15	229 05.2	36 38.4	09.1	102 31.4	16.2	191 46.5	11.2	31 39.0	57.8
16	244 07.7	51 38.0	10.4	117 32.3	15.9	206 49.2	11.1	46 41.2	57.9
17	259 10.2	66 37.7	11.7	132 33.2	15.6	221 51.9	11.0	61 43.4	58.0
18	274 12.6	81 37.3	S 4 12.9	147 34.1	N20 15.3	236 54.5	N13 10.9	76 45.6	S 4 58.1
19	289 15.1	96 36.9	14.2	162 35.0	14.9	251 57.2	10.9	91 47.8	58.2
20	304 17.5	111 36.5	15.5	177 35.9	14.6	266 59.9	10.8	106 49.9	58.4
21	319 20.0	126 36.1	16.7	192 36.8	14.3	282 02.5	10.7	121 52.1	58.5
22	334 22.5	141 35.8	18.0	207 37.7	14.0	297 05.2	10.7	136 54.3	58.6
23	349 24.9	156 35.4	19.3	222 38.6	13.6	312 07.9	10.6	151 56.5	58.7
26 00	4 27.4	171 35.0	S 4 20.5	237 39.5	N20 13.3	327 10.5	N13 10.5	166 58.7	S 4 58.8
01	19 29.9	186 34.6	21.8	252 40.4	13.0	342 13.2	10.4	182 00.9	58.9
02	34 32.3	201 34.2	23.0	267 41.3	12.7	357 15.9	10.4	197 03.1	59.0
03	49 34.8	216 33.8	24.3	282 42.2	12.3	12 18.5	10.3	212 05.3	59.2
04	64 37.3	231 33.4	25.6	297 43.1	12.0	27 21.2	10.2	227 07.4	59.3
05	79 39.7	246 33.1	26.8	312 44.0	11.7	42 23.9	10.1	242 09.6	59.4
06	94 42.2	261 32.7	S 4 28.1	327 44.9	N20 11.4	57 26.6	N13 10.1	257 11.8	S 4 59.5
07	109 44.6	276 32.3	29.4	342 45.8	11.1	72 29.2	10.0	272 14.0	59.6
08	124 47.1	291 31.9	30.6	357 46.7	10.7	87 31.9	09.9	287 16.2	59.7
M 09	139 49.6	306 31.5	31.9	12 47.6	10.4	102 34.6	09.9	302 18.4	4 59.9
O 10	154 52.0	321 31.1	33.2	27 48.5	10.1	117 37.2	09.8	317 20.6	5 00.0
N 11	169 54.5	336 30.8	34.4	42 49.4	09.8	132 39.9	09.7	332 22.8	00.1
D 12	184 57.0	351 30.4	S 4 35.7	57 50.3	N20 09.4	147 42.6	N13 09.6	347 25.0	S 5 00.2
A 13	199 59.4	6 30.0	36.9	72 51.2	09.1	162 45.3	09.6	2 27.1	00.3
Y 14	215 01.9	21 29.6	38.2	87 52.1	08.8	177 47.9	09.5	17 29.3	00.4
15	230 04.4	36 29.2	39.5	102 53.0	08.4	192 50.6	09.4	32 31.5	00.5
16	245 06.8	51 28.8	40.7	117 53.9	08.1	207 53.3	09.3	47 33.7	00.7
17	260 09.3	66 28.4	42.0	132 54.8	07.8	222 55.9	09.3	62 35.9	00.8
18	275 11.8	81 28.1	S 4 43.3	147 55.7	N20 07.5	237 58.6	N13 09.2	77 38.1	S 5 00.9
19	290 14.2	96 27.7	44.5	162 56.6	07.1	253 01.3	09.1	92 40.3	01.0
20	305 16.7	111 27.3	45.8	177 57.5	06.8	268 04.0	09.0	107 42.5	01.1
21	320 19.1	126 26.9	47.0	192 58.4	06.5	283 06.6	09.0	122 44.6	01.2
22	335 21.6	141 26.5	48.3	207 59.3	06.2	298 09.3	08.9	137 46.8	01.3
23	350 24.1	156 26.1	49.6	223 00.2	05.8	313 12.0	08.8	152 49.0	01.5
27 00	5 26.5	171 25.7	S 4 50.8	238 01.1	N20 05.5	328 14.7	N13 08.7	167 51.2	S 5 01.6
01	20 29.0	186 25.3	52.1	253 02.0	05.2	343 17.3	08.7	182 53.4	01.7
02	35 31.5	201 25.0	53.3	268 02.9	04.9	358 20.0	08.6	197 55.6	01.8
03	50 33.9	216 24.6	54.6	283 03.8	04.5	13 22.7	08.5	212 57.8	01.9
04	65 36.4	231 24.2	55.9	298 04.7	04.2	28 25.4	08.4	228 00.0	02.0
05	80 38.9	246 23.8	57.1	313 05.6	03.9	43 28.0	08.4	243 02.1	02.2
06	95 41.3	261 23.4	S 4 58.4	328 06.5	N20 03.5	58 30.7	N13 08.3	258 04.3	S 5 02.3
07	110 43.8	276 23.0	4 59.7	343 07.4	03.2	73 33.4	08.2	273 06.5	02.4
T 08	125 46.2	291 22.6	5 00.9	358 08.3	02.9	88 36.1	08.1	288 08.7	02.5
U 09	140 48.7	306 22.2	02.2	13 09.2	02.5	103 38.8	08.1	303 10.9	02.6
E 10	155 51.2	321 21.8	03.4	28 10.1	02.2	118 41.4	08.0	318 13.1	02.7
S 11	170 53.6	336 21.5	04.7	43 11.0	01.9	133 44.1	07.9	333 15.3	02.8
D 12	185 56.1	351 21.1	S 5 05.9	58 12.0	N20 01.6	148 46.8	N13 07.8	348 17.4	S 5 03.0
A 13	200 58.6	6 20.7	07.2	73 12.9	01.2	163 49.5	07.8	3 19.6	03.1
Y 14	216 01.0	21 20.3	08.5	88 13.8	00.9	178 52.2	07.7	18 21.8	03.2
15	231 03.5	36 19.9	09.7	103 14.7	00.6	193 54.8	07.6	33 24.0	03.3
16	246 06.0	51 19.5	11.0	118 15.6	20 00.2	208 57.5	07.5	48 26.2	03.4
17	261 08.4	66 19.1	12.2	133 16.5	19 59.9	224 00.2	07.5	63 28.4	03.5
18	276 10.9	81 18.7	S 5 13.5	148 17.4	N19 59.6	239 02.9	N13 07.4	78 30.6	S 5 03.6
19	291 13.4	96 18.3	14.8	163 18.3	59.2	254 05.6	07.3	93 32.8	03.8
20	306 15.8	111 17.9	16.0	178 19.2	58.9	269 08.2	07.2	108 34.9	03.9
21	321 18.3	126 17.5	17.3	193 20.1	58.6	284 10.9	07.2	123 37.1	04.0
22	336 20.7	141 17.2	18.5	208 21.0	58.3	299 13.6	07.1	138 39.3	04.1
23	351 23.2	156 16.8	19.8	223 21.9	57.9	314 16.3	07.0	153 41.5	04.2
	h m								
Mer. Pass.	23 38.3	*v* −0.4	*d* 1.3	*v* 0.9	*d* 0.3	*v* 2.7	*d* 0.1	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.9	S40 15.2
Achernar	335 27.1	S57 10.4
Acrux	173 11.4	S63 09.9
Adhara	255 13.6	S28 59.1
Aldebaran	290 50.6	N16 32.0
Alioth	166 22.2	N55 53.8
Alkaid	153 00.2	N49 15.4
Al Na'ir	27 44.8	S46 54.1
Alnilam	275 47.5	S 1 11.6
Alphard	217 57.5	S 8 42.5
Alphecca	126 12.2	N26 40.7
Alpheratz	357 44.4	N29 09.5
Altair	62 09.3	N 8 54.2
Ankaa	353 16.4	S42 14.3
Antares	112 27.9	S26 27.5
Arcturus	145 57.1	N19 07.4
Atria	107 31.0	S69 03.1
Avior	234 18.9	S59 32.6
Bellatrix	278 33.2	N 6 21.7
Betelgeuse	271 02.6	N 7 24.6
Canopus	263 56.7	S52 41.8
Capella	280 36.1	N46 00.4
Deneb	49 32.1	N45 19.7
Denebola	182 35.2	N14 30.4
Diphda	348 56.8	S17 55.1
Dubhe	193 53.7	N61 41.1
Elnath	278 14.1	N28 37.0
Eltanin	90 46.7	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.8
Gienah	175 53.9	S17 36.4
Hadar	148 50.3	S60 25.9
Hamal	328 01.8	N23 31.2
Kaus Aust.	83 45.4	S34 22.7
Kochab	137 20.7	N74 06.6
Markab	13 39.2	N15 16.4
Menkar	314 16.1	N 4 08.3
Menkent	148 09.4	S36 25.7
Miaplacidus	221 40.7	S69 45.8
Mirfak	308 41.8	N49 54.1
Nunki	75 59.8	S26 16.8
Peacock	53 20.8	S56 41.9
Pollux	243 29.3	N27 59.7
Procyon	245 01.1	N 5 11.7
Rasalhague	96 07.6	N12 33.3
Regulus	207 45.1	N11 54.6
Rigel	281 13.1	S 8 11.2
Rigil Kent.	139 54.0	S60 53.1
Sabik	102 14.0	S15 44.3
Schedar	349 41.4	N56 36.2
Shaula	96 23.6	S37 06.7
Sirius	258 34.8	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.7	S43 28.7
Vega	80 39.8	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	167 07.6	12 34
Mars	233 12.1	8 09
Jupiter	322 43.1	2 11
Saturn	162 31.3	12 50

UT	SUN			MOON						
	GHA		Dec	GHA		v		Dec		d	HP
d h	°	′	° ′	°	′	′		°	′	′	′
25 00	182	00.9	S 0 37.9	215	49.2	9.3	N	8	03.5	13.3	59.9
01	197	01.2	38.9	230	17.5	9.4		7	50.2	13.4	60.0
02	212	01.4	39.9	244	45.9	9.3		7	36.8	13.4	60.0
03	227	01.6	40.8	259	14.2	9.4		7	23.4	13.5	60.0
04	242	01.8	41.8	273	42.6	9.3		7	09.9	13.5	60.1
05	257	02.0	42.8	288	10.9	9.3		6	56.4	13.7	60.1
06	272	02.2	S 0 43.7	302	39.2	9.3	N	6	42.7	13.6	60.1
07	287	02.5	44.7	317	07.5	9.3		6	29.1	13.7	60.2
08	302	02.7	45.7	331	35.8	9.3		6	15.4	13.8	60.2
S 09	317	02.9	46.7	346	04.1	9.3		6	01.6	13.8	60.2
U 10	332	03.1	47.6	0	32.4	9.3		5	47.8	13.9	60.2
N 11	347	03.3	48.6	15	00.7	9.2		5	33.9	13.9	60.3
D 12	2	03.5	S 0 49.6	29	28.9	9.3	N	5	20.0	14.0	60.3
A 13	17	03.7	50.6	43	57.2	9.2		5	06.0	14.0	60.3
Y 14	32	04.0	51.5	58	25.4	9.2		4	52.0	14.0	60.4
15	47	04.2	52.5	72	53.6	9.2		4	38.0	14.1	60.4
16	62	04.4	53.5	87	21.8	9.2		4	23.9	14.2	60.4
17	77	04.6	54.5	101	50.0	9.2		4	09.7	14.2	60.5
18	92	04.8	S 0 55.4	116	18.2	9.2	N	3	55.5	14.2	60.5
19	107	05.0	56.4	130	46.4	9.2		3	41.3	14.2	60.5
20	122	05.3	57.4	145	14.6	9.1		3	27.1	14.3	60.5
21	137	05.5	58.4	159	42.7	9.1		3	12.8	14.3	60.6
22	152	05.7	0 59.3	174	10.8	9.1		2	58.5	14.3	60.6
23	167	05.9	1 00.3	188	38.9	9.1		2	44.2	14.4	60.6
26 00	182	06.1	S 1 01.3	203	07.0	9.1	N	2	29.8	14.4	60.7
01	197	06.3	02.3	217	35.1	9.0		2	15.4	14.4	60.7
02	212	06.5	03.2	232	03.1	9.0		2	01.0	14.5	60.7
03	227	06.8	04.2	246	31.1	9.0		1	46.5	14.5	60.7
04	242	07.0	05.2	260	59.1	9.0		1	32.0	14.5	60.8
05	257	07.2	06.2	275	27.1	9.0		1	17.5	14.5	60.8
06	272	07.4	S 1 07.1	289	55.1	8.9	N	1	03.0	14.5	60.8
07	287	07.6	08.1	304	23.0	8.9		0	48.5	14.6	60.8
08	302	07.8	09.1	318	50.9	8.9		0	33.9	14.5	60.9
M 09	317	08.0	10.0	333	18.8	8.9		0	19.4	14.6	60.9
O 10	332	08.3	11.0	347	46.7	8.8	N	0	04.8	14.6	60.9
N 11	347	08.5	12.0	2	14.5	8.9	S	0	09.8	14.6	60.9
D 12	2	08.7	S 1 13.0	16	42.4	8.7	S	0	24.4	14.6	60.9
A 13	17	08.9	13.9	31	10.1	8.8		0	39.0	14.6	61.0
Y 14	32	09.1	14.9	45	37.9	8.7		0	53.6	14.6	61.0
15	47	09.3	15.9	60	05.6	8.7		1	08.2	14.6	61.0
16	62	09.5	16.9	74	33.3	8.7		1	22.8	14.6	61.0
17	77	09.8	17.8	89	01.0	8.7		1	37.4	14.6	61.0
18	92	10.0	S 1 18.8	103	28.7	8.6	S	1	52.0	14.7	61.1
19	107	10.2	19.8	117	56.3	8.6		2	06.7	14.6	61.1
20	122	10.4	20.8	132	23.9	8.5		2	21.3	14.6	61.1
21	137	10.6	21.7	146	51.4	8.5		2	35.9	14.5	61.1
22	152	10.8	22.7	161	18.9	8.5		2	50.4	14.6	61.1
23	167	11.0	23.7	175	46.4	8.5		3	05.0	14.6	61.1
27 00	182	11.2	S 1 24.7	190	13.9	8.4	S	3	19.6	14.5	61.1
01	197	11.5	25.6	204	41.3	8.4		3	34.1	14.6	61.2
02	212	11.7	26.6	219	08.7	8.3		3	48.7	14.5	61.2
03	227	11.9	27.6	233	36.0	8.3		4	03.2	14.5	61.2
04	242	12.1	28.5	248	03.3	8.3		4	17.7	14.5	61.2
05	257	12.3	29.5	262	30.6	8.2		4	32.2	14.4	61.2
06	272	12.5	S 1 30.5	276	57.8	8.2	S	4	46.6	14.5	61.2
07	287	12.7	31.5	291	25.0	8.2		5	01.1	14.4	61.2
T 08	302	12.9	32.4	305	52.2	8.1		5	15.5	14.3	61.2
U 09	317	13.2	33.4	320	19.3	8.1		5	29.8	14.4	61.3
E 10	332	13.4	34.4	334	46.4	8.1		5	44.2	14.3	61.3
S 11	347	13.6	35.4	349	13.5	8.0		5	58.5	14.3	61.3
D 12	2	13.8	S 1 36.3	3	40.5	7.9	S	6	12.8	14.2	61.3
A 13	17	14.0	37.3	18	07.4	7.9		6	27.0	14.2	61.3
Y 14	32	14.2	38.3	32	34.3	7.9		6	41.2	14.2	61.3
15	47	14.4	39.3	47	01.2	7.9		6	55.4	14.1	61.3
16	62	14.6	40.2	61	28.1	7.7		7	09.5	14.1	61.3
17	77	14.8	41.2	75	54.8	7.8		7	23.6	14.0	61.3
18	92	15.1	S 1 42.2	90	21.6	7.7	S	7	37.6	14.0	61.3
19	107	15.3	43.2	104	48.3	7.7		7	51.6	13.9	61.3
20	122	15.5	44.1	119	15.0	7.6		8	05.5	13.9	61.3
21	137	15.7	45.1	133	41.6	7.6		8	19.4	13.8	61.3
22	152	15.9	46.1	148	08.2	7.5		8	33.2	13.8	61.3
23	167	16.1	47.0	162	34.7	7.5	S	8	47.0	13.7	61.3
	SD	16.0	d 1.0	SD		16.4			16.6		16.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 25	Moonrise 26	Moonrise 27	Moonrise 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	03 20	04 47	05 54	02 07	04 21	06 37	09 03
N 70	03 36	04 53	05 54	02 18	04 23	06 30	08 43
68	03 49	04 58	05 54	02 28	04 25	06 24	08 27
66	04 00	05 02	05 53	02 35	04 26	06 19	08 14
64	04 08	05 06	05 53	02 42	04 27	06 14	08 04
62	04 15	05 09	05 53	02 47	04 28	06 11	07 55
60	04 21	05 11	05 53	02 52	04 29	06 07	07 48
N 58	04 27	05 13	05 52	02 56	04 29	06 05	07 41
56	04 31	05 15	05 52	03 00	04 30	06 02	07 36
54	04 35	05 17	05 52	03 03	04 31	06 00	07 30
52	04 39	05 18	05 52	03 06	04 31	05 58	07 26
50	04 42	05 19	05 52	03 09	04 32	05 56	07 21
45	04 48	05 22	05 51	03 15	04 33	05 52	07 12
N 40	04 52	05 24	05 51	03 20	04 33	05 49	07 05
35	04 56	05 25	05 51	03 24	04 34	05 46	06 59
30	04 59	05 26	05 50	03 28	04 35	05 43	06 53
20	05 02	05 28	05 50	03 34	04 36	05 39	06 43
N 10	05 04	05 28	05 49	03 40	04 37	05 35	06 35
0	05 04	05 28	05 48	03 45	04 38	05 32	06 27
S 10	05 02	05 26	05 47	03 51	04 39	05 28	06 19
20	04 59	05 24	05 46	03 56	04 40	05 25	06 11
30	04 53	05 21	05 45	04 03	04 41	05 21	06 02
35	04 50	05 19	05 44	04 06	04 42	05 19	05 57
40	04 45	05 16	05 43	04 10	04 43	05 16	05 51
45	04 39	05 13	05 42	04 15	04 44	05 13	05 44
S 50	04 30	05 09	05 41	04 21	04 45	05 09	05 36
52	04 27	05 07	05 40	04 24	04 46	05 08	05 32
54	04 22	05 04	05 40	04 26	04 46	05 06	05 28
56	04 17	05 02	05 39	04 30	04 47	05 04	05 23
58	04 11	04 59	05 38	04 33	04 48	05 02	05 18
S 60	04 05	04 55	05 37	04 37	04 48	05 00	05 13

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 25	Moonset 26	Moonset 27	Moonset 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	17 46	18 53	20 19	17 02	16 42	16 20	15 53
N 70	17 47	18 47	20 03	16 57	16 44	16 31	16 15
68	17 47	18 43	19 51	16 52	16 46	16 40	16 32
66	17 48	18 39	19 41	16 49	16 48	16 47	16 46
64	17 48	18 35	19 32	16 45	16 49	16 53	16 58
62	17 49	18 33	19 25	16 43	16 50	16 58	17 08
60	17 49	18 30	19 20	16 40	16 51	17 03	17 17
N 58	17 49	18 28	19 15	16 38	16 52	17 07	17 25
56	17 50	18 26	19 10	16 36	16 53	17 11	17 31
54	17 50	18 25	19 06	16 34	16 54	17 14	17 37
52	17 50	18 24	19 03	16 33	16 54	17 17	17 43
50	17 50	18 22	19 00	16 31	16 55	17 20	17 48
45	17 51	18 20	18 54	16 28	16 56	17 26	17 59
N 40	17 51	18 18	18 50	16 25	16 58	17 31	18 07
35	17 52	18 17	18 46	16 23	16 59	17 36	18 15
30	17 52	18 16	18 44	16 20	16 59	17 39	18 22
20	17 53	18 15	18 41	16 17	17 01	17 46	18 34
N 10	17 54	18 15	18 39	16 13	17 02	17 52	18 44
0	17 55	18 15	18 39	16 10	17 03	17 58	18 54
S 10	17 56	18 17	18 41	16 07	17 05	18 03	19 04
20	17 57	18 19	18 44	16 04	17 06	18 09	19 14
30	17 58	18 22	18 50	16 00	17 07	18 16	19 26
35	17 59	18 24	18 54	15 57	17 08	18 20	19 33
40	18 00	18 27	18 59	15 55	17 09	18 25	19 41
45	18 01	18 31	19 05	15 52	17 10	18 30	19 51
S 50	18 03	18 35	19 14	15 48	17 11	18 36	20 02
52	18 03	18 37	19 18	15 46	17 12	18 39	20 07
54	18 04	18 40	19 22	15 44	17 12	18 42	20 13
56	18 05	18 42	19 27	15 42	17 13	18 46	20 19
58	18 06	18 46	19 33	15 40	17 14	18 50	20 27
S 60	18 07	18 49	19 40	15 37	17 15	18 54	20 35

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
25	08 03	08 14	11 52	09 58	22 24	27	6
26	08 24	08 34	11 51	10 51	23 18	28	2
27	08 45	08 55	11 51	11 45	24 12	00	0

UT	ARIES	VENUS −3.9		MARS +1.3		JUPITER −2.8		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
28 00	6 25.7	171 16.4	S 5 21.0	238 22.9	N19 57.6	329 19.0	N13 06.9	168 43.7	S 5 04.3
01	21 28.1	186 16.0	22.3	253 23.8	57.3	344 21.6	06.9	183 45.9	04.5
02	36 30.6	201 15.6	23.6	268 24.7	56.9	359 24.3	06.8	198 48.1	04.6
03	51 33.1	216 15.2 . .	24.8	283 25.6 . .	56.6	14 27.0 . .	06.7	213 50.2 . .	04.7
04	66 35.5	231 14.8	26.1	298 26.5	56.3	29 29.7	06.6	228 52.4	04.8
05	81 38.0	246 14.4	27.3	313 27.4	55.9	44 32.4	06.5	243 54.6	04.9
06	96 40.5	261 14.0 S 5	28.6	328 28.3 N19	55.6	59 35.1 N13	06.5	258 56.8 S 5	05.0
W 07	111 42.9	276 13.6	29.8	343 29.2	55.3	74 37.7	06.4	273 59.0	05.1
E 08	126 45.4	291 13.2	31.1	358 30.1	54.9	89 40.4	06.3	289 01.2	05.3
D 09	141 47.8	306 12.8 . .	32.3	13 31.1 . .	54.6	104 43.1 . .	06.2	304 03.4 . .	05.4
N 10	156 50.3	321 12.4	33.6	28 32.0	54.3	119 45.8	06.2	319 05.6	05.5
E 11	171 52.8	336 12.0	34.9	43 32.9	53.9	134 48.5	06.1	334 07.7	05.6
S 12	186 55.2	351 11.7 S 5	36.1	58 33.8 N19	53.6	149 51.2 N13	06.0	349 09.9 S 5	05.7
D 13	201 57.7	6 11.3	37.4	73 34.7	53.3	164 53.9	05.9	4 12.1	05.8
A 14	217 00.2	21 10.9	38.6	88 35.6	52.9	179 56.5	05.8	19 14.3	05.9
Y 15	232 02.6	36 10.5 . .	39.9	103 36.5 . .	52.6	194 59.2 . .	05.8	34 16.5 . .	06.1
16	247 05.1	51 10.1	41.1	118 37.4	52.3	210 01.9	05.7	49 18.7	06.2
17	262 07.6	66 09.7	42.4	133 38.4	51.9	225 04.6	05.6	64 20.9	06.3
18	277 10.0	81 09.3 S 5	43.6	148 39.3 N19	51.6	240 07.3 N13	05.5	79 23.0 S 5	06.4
19	292 12.5	96 08.9	44.9	163 40.2	51.3	255 10.0	05.5	94 25.2	06.5
20	307 15.0	111 08.5	46.1	178 41.1	50.9	270 12.7	05.4	109 27.4	06.6
21	322 17.4	126 08.1 . .	47.4	193 42.0 . .	50.6	285 15.4 . .	05.3	124 29.6 . .	06.8
22	337 19.9	141 07.7	48.7	208 42.9	50.3	300 18.0	05.2	139 31.8	06.9
23	352 22.3	156 07.3	49.9	223 43.9	49.9	315 20.7	05.1	154 34.0	07.0
29 00	7 24.8	171 06.9 S 5	51.2	238 44.8 N19	49.6	330 23.4 N13	05.1	169 36.2 S 5	07.1
01	22 27.3	186 06.5	52.4	253 45.7	49.2	345 26.1	05.0	184 38.3	07.2
02	37 29.7	201 06.1	53.7	268 46.6	48.9	0 28.8	04.9	199 40.5	07.3
03	52 32.2	216 05.7 . .	54.9	283 47.5 . .	48.6	15 31.5 . .	04.8	214 42.7 . .	07.4
04	67 34.7	231 05.3	56.2	298 48.4	48.2	30 34.2	04.7	229 44.9	07.6
05	82 37.1	246 04.9	57.4	313 49.4	47.9	45 36.9	04.7	244 47.1	07.7
06	97 39.6	261 04.5 S 5	58.7	328 50.3 N19	47.6	60 39.6 N13	04.6	259 49.3 S 5	07.8
T 07	112 42.1	276 04.1 5	59.9	343 51.2	47.2	75 42.2	04.5	274 51.5	07.9
H 08	127 44.5	291 03.7 6	01.2	358 52.1	46.9	90 44.9	04.4	289 53.6	08.0
U 09	142 47.0	306 03.3 . .	02.4	13 53.0 . .	46.6	105 47.6 . .	04.4	304 55.8 . .	08.1
R 10	157 49.5	321 02.9	03.7	28 54.0	46.2	120 50.3	04.3	319 58.0	08.3
S 11	172 51.9	336 02.5	04.9	43 54.9	45.9	135 53.0	04.2	335 00.2	08.4
D 12	187 54.4	351 02.1 S 6	06.2	58 55.8 N19	45.5	150 55.7 N13	04.1	350 02.4 S 5	08.5
A 13	202 56.8	6 01.7	07.4	73 56.7	45.2	165 58.4	04.0	5 04.6	08.6
Y 14	217 59.3	21 01.3	08.7	88 57.6	44.9	181 01.1	04.0	20 06.8	08.7
15	233 01.8	36 00.9 . .	09.9	103 58.6 . .	44.5	196 03.8 . .	03.9	35 08.9 . .	08.8
16	248 04.2	51 00.5	11.2	118 59.5	44.2	211 06.5	03.8	50 11.1	08.9
17	263 06.7	66 00.1	12.4	134 00.4	43.9	226 09.2	03.7	65 13.3	09.1
18	278 09.2	80 59.7 S 6	13.7	149 01.3 N19	43.5	241 11.9 N13	03.6	80 15.5 S 5	09.2
19	293 11.6	95 59.3	14.9	164 02.2	43.2	256 14.6	03.6	95 17.7	09.3
20	308 14.1	110 58.9	16.2	179 03.2	42.8	271 17.2	03.5	110 19.9	09.4
21	323 16.6	125 58.5 . .	17.4	194 04.1 . .	42.5	286 19.9 . .	03.4	125 22.0 . .	09.5
22	338 19.0	140 58.1	18.7	209 05.0	42.2	301 22.6	03.3	140 24.2	09.6
23	353 21.5	155 57.7	19.9	224 05.9	41.8	316 25.3	03.2	155 26.4	09.8
30 00	8 23.9	170 57.3 S 6	21.2	239 06.9 N19	41.5	331 28.0 N13	03.2	170 28.6 S 5	09.9
01	23 26.4	185 56.9	22.4	254 07.8	41.1	346 30.7	03.1	185 30.8	10.0
02	38 28.9	200 56.5	23.6	269 08.7	40.8	1 33.4	03.0	200 33.0	10.1
03	53 31.3	215 56.1 . .	24.9	284 09.6 . .	40.5	16 36.1 . .	02.9	215 35.2 . .	10.2
04	68 33.8	230 55.7	26.1	299 10.6	40.1	31 38.8	02.8	230 37.3	10.3
05	83 36.3	245 55.3	27.4	314 11.5	39.8	46 41.5	02.7	245 39.5	10.4
06	98 38.7	260 54.9 S 6	28.6	329 12.4 N19	39.4	61 44.2 N13	02.7	260 41.7 S 5	10.6
07	113 41.2	275 54.5	29.9	344 13.3	39.1	76 46.9	02.6	275 43.9	10.7
08	128 43.7	290 54.1	31.1	359 14.3	38.8	91 49.6	02.5	290 46.1	10.8
F 09	143 46.1	305 53.7 . .	32.4	14 15.2 . .	38.4	106 52.3 . .	02.4	305 48.3 . .	10.9
R 10	158 48.6	320 53.3	33.6	29 16.1	38.1	121 55.0	02.3	320 50.5	11.0
I 11	173 51.1	335 52.9	34.9	44 17.0	37.7	136 57.7	02.3	335 52.6	11.1
D 12	188 53.5	350 52.5 S 6	36.1	59 18.0 N19	37.4	152 00.4 N13	02.2	350 54.8 S 5	11.3
A 13	203 56.0	5 52.1	37.3	74 18.9	37.1	167 03.1	02.1	5 57.0	11.4
Y 14	218 58.4	20 51.7	38.6	89 19.8	36.7	182 05.8	02.0	20 59.2	11.5
15	234 00.9	35 51.3 . .	39.8	104 20.7 . .	36.4	197 08.5 . .	01.9	36 01.4 . .	11.6
16	249 03.4	50 50.9	41.1	119 21.7	36.0	212 11.2	01.9	51 03.6	11.7
17	264 05.8	65 50.5	42.3	134 22.6	35.7	227 13.9	01.8	66 05.7	11.8
18	279 08.3	80 50.1 S 6	43.6	149 23.5 N19	35.3	242 16.6 N13	01.7	81 07.9 S 5	11.9
19	294 10.8	95 49.7	44.8	164 24.5	35.0	257 19.3	01.6	96 10.1	12.1
20	309 13.2	110 49.2	46.0	179 25.4	34.7	272 22.0	01.5	111 12.3	12.2
21	324 15.7	125 48.8 . .	47.3	194 26.3 . .	34.3	287 24.7 . .	01.4	126 14.5 . .	12.3
22	339 18.2	140 48.4	48.5	209 27.2	34.0	302 27.4	01.4	141 16.7	12.4
23	354 20.6	155 48.0	49.8	224 28.2	33.6	317 30.1	01.3	156 18.9	12.5
	h m								
Mer. Pass.	23 26.5	*v* −0.4	*d* 1.2	*v* 0.9	*d* 0.3	*v* 2.7	*d* 0.1	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.9	S40 15.2
Achernar	335 27.0	S57 10.4
Acrux	173 11.4	S63 09.9
Adhara	255 13.5	S28 59.1
Aldebaran	290 50.6	N16 32.0
Alioth	166 22.2	N55 53.8
Alkaid	153 00.2	N49 15.4
Al Na'ir	27 44.8	S46 54.2
Alnilam	275 47.5	S 1 11.6
Alphard	217 57.5	S 8 42.5
Alphecca	126 12.3	N26 40.7
Alpheratz	357 44.4	N29 09.6
Altair	62 09.3	N 8 54.2
Ankaa	353 16.4	S42 14.3
Antares	112 27.9	S26 27.5
Arcturus	145 57.1	N19 07.4
Atria	107 31.1	S69 03.1
Avior	234 18.9	S59 32.6
Bellatrix	278 33.2	N 6 21.7
Betelgeuse	271 02.6	N 7 24.6
Canopus	263 56.7	S52 41.8
Capella	280 36.1	N46 00.4
Deneb	49 32.1	N45 19.7
Denebola	182 35.2	N14 30.4
Diphda	348 56.8	S17 55.1
Dubhe	193 53.7	N61 41.1
Elnath	278 14.1	N28 36.9
Eltanin	90 46.8	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.8
Gienah	175 53.9	S17 36.4
Hadar	148 50.3	S60 25.9
Hamal	328 01.8	N23 31.2
Kaus Aust.	83 45.4	S34 22.7
Kochab	137 20.8	N74 06.6
Markab	13 39.3	N15 16.4
Menkar	314 16.1	N 4 08.3
Menkent	148 09.4	S36 25.7
Miaplacidus	221 40.6	S69 45.8
Mirfak	308 41.8	N49 54.1
Nunki	75 59.8	S26 16.8
Peacock	53 20.8	S56 41.9
Pollux	243 29.3	N27 59.7
Procyon	245 01.1	N 5 11.7
Rasalhague	96 07.7	N12 33.3
Regulus	207 45.1	N11 54.6
Rigel	281 13.1	S 8 11.2
Rigil Kent.	139 54.0	S60 53.1
Sabik	102 14.0	S15 44.3
Schedar	349 41.4	N56 36.3
Shaula	96 23.7	S37 06.7
Sirius	258 34.8	S16 43.8
Spica	158 32.9	S11 13.3
Suhail	222 53.7	S43 28.7
Vega	80 39.8	N38 48.1
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	163 42.1	12 36
Mars	231 20.0	8 05
Jupiter	322 58.6	1 58
Saturn	162 11.3	12 40

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
28 00	182 16.3	S 1 48.0	177 01.2	7.4	S 9 00.7	13.7	61.3
01	197 16.5	49.0	191 27.6	7.4	9 14.4	13.6	61.3
02	212 16.7	50.0	205 54.0	7.3	9 28.0	13.5	61.3
03	227 17.0	. . 50.9	220 20.3	7.3	9 41.5	13.5	61.3
04	242 17.2	51.9	234 46.6	7.3	9 55.0	13.4	61.3
05	257 17.4	52.9	249 12.9	7.2	10 08.4	13.3	61.3
06	272 17.6	S 1 53.9	263 39.1	7.2	S10 21.7	13.3	61.3
W 07	287 17.8	54.8	278 05.3	7.1	10 35.0	13.2	61.3
E 08	302 18.0	55.8	292 31.4	7.0	10 48.2	13.1	61.3
D 09	317 18.2	. . 56.8	306 57.4	7.0	11 01.3	13.1	61.3
N 10	332 18.4	57.8	321 23.4	7.0	11 14.4	12.9	61.3
E 11	347 18.6	58.7	335 49.4	6.9	11 27.3	12.9	61.3
S 12	2 18.8	S 1 59.7	350 15.3	6.9	S11 40.2	12.8	61.3
D 13	17 19.0	2 00.7	4 41.2	6.8	11 53.0	12.8	61.3
A 14	32 19.3	01.6	19 07.0	6.8	12 05.8	12.6	61.3
Y 15	47 19.5	. . 02.6	33 32.8	6.7	12 18.4	12.6	61.3
16	62 19.7	03.6	47 58.5	6.7	12 31.0	12.4	61.3
17	77 19.9	04.6	62 24.2	6.6	12 43.4	12.4	61.3
18	92 20.1	S 2 05.5	76 49.8	6.6	S12 55.8	12.3	61.2
19	107 20.3	06.5	91 15.4	6.6	13 08.1	12.2	61.2
20	122 20.5	07.5	105 41.0	6.5	13 20.3	12.1	61.2
21	137 20.7	. . 08.5	120 06.5	6.4	13 32.4	12.0	61.2
22	152 20.9	09.4	134 31.9	6.4	13 44.4	11.9	61.2
23	167 21.1	10.4	148 57.3	6.3	13 56.3	11.9	61.2
29 00	182 21.3	S 2 11.4	163 22.6	6.3	S14 08.2	11.7	61.2
01	197 21.6	12.3	177 47.9	6.3	14 19.9	11.6	61.2
02	212 21.8	13.3	192 13.2	6.2	14 31.5	11.5	61.2
03	227 22.0	. . 14.3	206 38.4	6.2	14 43.0	11.4	61.1
04	242 22.2	15.3	221 03.6	6.1	14 54.4	11.3	61.1
05	257 22.4	16.2	235 28.7	6.1	15 05.7	11.1	61.1
06	272 22.6	S 2 17.2	249 53.8	6.0	S15 16.8	11.1	61.1
T 07	287 22.8	18.2	264 18.8	6.0	15 27.9	11.0	61.1
H 08	302 23.0	19.2	278 43.8	5.9	15 38.9	10.8	61.1
U 09	317 23.2	. . 20.1	293 08.7	5.9	15 49.7	10.8	61.0
R 10	332 23.4	21.1	307 33.6	5.8	16 00.5	10.6	61.0
S 11	347 23.6	22.1	321 58.4	5.9	16 11.1	10.5	61.0
D 12	2 23.8	S 2 23.0	336 23.3	5.7	S16 21.6	10.4	61.0
A 13	17 24.0	24.0	350 48.0	5.7	16 32.0	10.2	61.0
Y 14	32 24.3	25.0	5 12.7	5.7	16 42.2	10.2	60.9
15	47 24.5	. . 26.0	19 37.4	5.7	16 52.4	10.0	60.9
16	62 24.7	26.9	34 02.1	5.6	17 02.4	9.9	60.9
17	77 24.9	27.9	48 26.7	5.6	17 12.3	9.7	60.9
18	92 25.1	S 2 28.9	62 51.3	5.5	S17 22.0	9.7	60.9
19	107 25.3	29.8	77 15.8	5.5	17 31.7	9.5	60.8
20	122 25.5	30.8	91 40.3	5.4	17 41.2	9.3	60.8
21	137 25.7	. . 31.8	106 04.7	5.5	17 50.5	9.3	60.8
22	152 25.9	32.8	120 29.2	5.3	17 59.8	9.1	60.8
23	167 26.1	33.7	134 53.5	5.4	18 08.9	9.0	60.8
30 00	182 26.3	S 2 34.7	149 17.9	5.3	S18 17.9	8.8	60.7
01	197 26.5	35.7	163 42.2	5.3	18 26.7	8.8	60.7
02	212 26.7	36.6	178 06.5	5.3	18 35.5	8.5	60.7
03	227 26.9	. . 37.6	192 30.8	5.2	18 44.0	8.5	60.7
04	242 27.1	38.6	206 55.0	5.2	18 52.5	8.3	60.6
05	257 27.3	39.6	221 19.2	5.2	19 00.8	8.1	60.6
06	272 27.5	S 2 40.5	235 43.4	5.1	S19 08.9	8.1	60.6
07	287 27.8	41.5	250 07.5	5.1	19 17.0	7.9	60.5
08	302 28.0	42.5	264 31.6	5.1	19 24.9	7.7	60.5
F 09	317 28.2	. . 43.4	278 55.7	5.1	19 32.6	7.6	60.5
R 10	332 28.4	44.4	293 19.8	5.1	19 40.2	7.4	60.5
I 11	347 28.6	45.4	307 43.9	5.0	19 47.6	7.4	60.4
D 12	2 28.8	S 2 46.4	322 07.9	5.0	S19 55.0	7.1	60.4
A 13	17 29.0	47.3	336 31.9	5.0	20 02.1	7.0	60.4
Y 14	32 29.2	48.3	350 55.9	5.0	20 09.1	6.9	60.4
15	47 29.4	. . 49.3	5 19.9	4.9	20 16.0	6.7	60.3
16	62 29.6	50.2	19 43.8	5.0	20 22.7	6.6	60.3
17	77 29.8	51.2	34 07.8	4.9	20 29.3	6.4	60.3
18	92 30.0	S 2 52.2	48 31.7	4.9	S20 35.7	6.3	60.2
19	107 30.2	53.2	62 55.6	4.9	20 42.0	6.1	60.2
20	122 30.4	54.1	77 19.5	4.9	20 48.1	6.0	60.2
21	137 30.6	. . 55.1	91 43.4	4.9	20 54.1	5.8	60.1
22	152 30.8	56.1	106 07.3	4.9	20 59.9	5.7	60.1
23	167 31.0	57.0	120 31.2	4.9	S21 05.6	5.5	60.1
	SD 16.0	d 1.0	SD 16.7		16.6		16.5

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		28	29	30	1
°	h m	h m	h m	h m	h m	h m	h m
N 72	03 36	05 01	06 08	09 03	11 58	▬	▬
N 70	03 50	05 05	06 06	08 43	11 08	▬	▬
68	04 01	05 09	06 04	08 27	10 37	12 56	▬
66	04 10	05 12	06 03	08 14	10 14	12 13	14 04
64	04 18	05 14	06 02	08 04	09 56	11 45	13 22
62	04 24	05 16	06 01	07 55	09 41	11 23	12 53
60	04 29	05 18	06 00	07 48	09 29	11 05	12 31
N 58	04 34	05 20	05 59	07 41	09 18	10 51	12 14
56	04 37	05 21	05 58	07 36	09 09	10 38	11 59
54	04 41	05 22	05 57	07 30	09 01	10 27	11 46
52	04 44	05 23	05 57	07 26	08 53	10 18	11 34
50	04 46	05 24	05 56	07 21	08 47	10 09	11 24
45	04 52	05 26	05 55	07 12	08 33	09 51	11 03
N 40	04 55	05 27	05 54	07 05	08 22	09 36	10 47
35	04 58	05 28	05 53	06 59	08 12	09 24	10 32
30	05 00	05 28	05 52	06 53	08 03	09 13	10 20
20	05 03	05 28	05 50	06 43	07 49	08 55	09 59
N 10	05 03	05 28	05 49	06 35	07 36	08 38	09 41
0	05 02	05 26	05 47	06 27	07 24	08 24	09 24
S 10	05 00	05 25	05 46	06 19	07 13	08 09	09 07
20	04 56	05 22	05 44	06 11	07 00	07 53	08 49
30	04 49	05 17	05 41	06 02	06 46	07 35	08 28
35	04 45	05 15	05 40	05 57	06 38	07 24	08 16
40	04 40	05 11	05 38	05 51	06 29	07 13	08 02
45	04 33	05 07	05 37	05 44	06 19	06 59	07 46
S 50	04 23	05 02	05 34	05 36	06 06	06 42	07 26
52	04 19	05 00	05 33	05 32	06 00	06 34	07 16
54	04 14	04 57	05 32	05 28	05 53	06 25	07 05
56	04 09	04 54	05 31	05 23	05 46	06 15	06 53
58	04 02	04 50	05 30	05 18	05 38	06 04	06 39
S 60	03 55	04 46	05 28	05 13	05 29	05 51	06 23

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	28	29	30	1
°	h m	h m	h m	h m	h m	h m	h m
N 72	17 31	18 38	20 01	15 53	14 59	▬	▬
N 70	17 33	18 33	19 47	16 15	15 51	▬	▬
68	17 35	18 30	19 37	16 32	16 23	16 09	▬
66	17 36	18 27	19 28	16 46	16 48	16 52	17 07
64	17 38	18 25	19 21	16 58	17 07	17 21	17 50
62	17 39	18 23	19 15	17 08	17 22	17 44	18 19
60	17 40	18 21	19 10	17 17	17 35	18 02	18 41
N 58	17 41	18 20	19 06	17 25	17 47	18 17	18 59
56	17 42	18 19	19 02	17 31	17 57	18 30	19 14
54	17 42	18 17	18 59	17 37	18 05	18 41	19 27
52	17 43	18 17	18 56	17 43	18 13	18 51	19 38
50	17 44	18 16	18 53	17 48	18 20	19 00	19 49
45	17 45	18 14	18 48	17 59	18 36	19 19	20 10
N 40	17 46	18 13	18 45	18 07	18 48	19 35	20 27
35	17 47	18 13	18 42	18 15	18 59	19 48	20 42
30	17 48	18 12	18 40	18 22	19 08	19 59	20 54
20	17 50	18 12	18 38	18 34	19 25	20 19	21 16
N 10	17 52	18 13	18 37	18 44	19 39	20 36	21 35
0	17 54	18 14	18 38	18 54	19 52	20 52	21 52
S 10	17 55	18 16	18 41	19 04	20 06	21 08	22 10
20	17 58	18 20	18 45	19 14	20 20	21 25	22 28
30	18 00	18 24	18 52	19 26	20 37	21 45	22 50
35	18 01	18 27	18 56	19 33	20 46	21 57	23 03
40	18 03	18 30	19 02	19 41	20 57	22 10	23 17
45	18 05	18 34	19 09	19 51	21 10	22 26	23 34
S 50	18 07	18 40	19 19	20 02	21 26	22 45	23 56
52	18 08	18 42	19 23	20 07	21 34	22 55	24 06
54	18 10	18 45	19 28	20 13	21 42	23 05	24 17
56	18 11	18 49	19 34	20 19	21 51	23 17	24 30
58	18 13	18 52	19 41	20 27	22 02	23 30	24 46
S 60	18 14	18 57	19 48	20 35	22 14	23 46	25 04

Day	SUN			MOON				
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
28	09 05	09 15	11 51	12 41	00 12	01	2
29	09 25	09 35	11 50	13 38	01 09	02	6
30	09 45	09 55	11 50	14 38	02 08	03	13

UT	ARIES	VENUS −3.9		MARS +1.3		JUPITER −2.8		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
1 00	9 23.1	170 47.6	S 6 51.0	239 29.1	N19 33.3	332 32.8	N13 01.2	171 21.0	S 5 12.6
01	24 25.6	185 47.2	52.3	254 30.0	32.9	347 35.5	01.1	186 23.2	12.7
02	39 28.0	200 46.8	53.5	269 31.0	32.6	2 38.2	01.0	201 25.4	12.9
03	54 30.5	215 46.4	54.7	284 31.9	32.3	17 40.9	00.9	216 27.6	13.0
04	69 32.9	230 46.0	56.0	299 32.8	31.9	32 43.6	00.9	231 29.8	13.1
05	84 35.4	245 45.6	57.2	314 33.8	31.6	47 46.3	00.8	246 32.0	13.2
06	99 37.9	260 45.2	S 6 58.5	329 34.7	N19 31.2	62 49.0	N13 00.7	261 34.1	S 5 13.3
07	114 40.3	275 44.8	6 59.7	344 35.6	30.9	77 51.7	00.6	276 36.3	13.4
S 08	129 42.8	290 44.4	7 00.9	359 36.5	30.5	92 54.4	00.5	291 38.5	13.6
A 09	144 45.3	305 43.9	02.2	14 37.5	30.2	107 57.1	00.4	306 40.7	13.7
T 10	159 47.7	320 43.5	03.4	29 38.4	29.8	122 59.8	00.4	321 42.9	13.8
U 11	174 50.2	335 43.1	04.7	44 39.3	29.5	138 02.5	00.3	336 45.1	13.9
R 12	189 52.7	350 42.7	S 7 05.9	59 40.3	N19 29.2	153 05.2	N13 00.2	351 47.2	S 5 14.0
D 13	204 55.1	5 42.3	07.1	74 41.2	28.8	168 07.9	00.1	6 49.4	14.1
A 14	219 57.6	20 41.9	08.4	89 42.1	28.5	183 10.6	13 00.0	21 51.6	14.2
Y 15	235 00.0	35 41.5	09.6	104 43.1	28.1	198 13.3	12 59.9	36 53.8	14.4
16	250 02.5	50 41.1	10.8	119 44.0	27.8	213 16.0	59.9	51 56.0	14.5
17	265 05.0	65 40.7	12.1	134 45.0	27.4	228 18.7	59.8	66 58.2	14.6
18	280 07.4	80 40.2	S 7 13.3	149 45.9	N19 27.1	243 21.4	N12 59.7	82 00.4	S 5 14.7
19	295 09.9	95 39.8	14.6	164 46.8	26.7	258 24.2	59.6	97 02.5	14.8
20	310 12.4	110 39.4	15.8	179 47.8	26.4	273 26.9	59.5	112 04.7	14.9
21	325 14.8	125 39.0	17.0	194 48.7	26.0	288 29.6	59.4	127 06.9	15.1
22	340 17.3	140 38.6	18.3	209 49.6	25.7	303 32.3	59.4	142 09.1	15.2
23	355 19.8	155 38.2	19.5	224 50.6	25.4	318 35.0	59.3	157 11.3	15.3
2 00	10 22.2	170 37.8	S 7 20.7	239 51.5	N19 25.0	333 37.7	N12 59.2	172 13.5	S 5 15.4
01	25 24.7	185 37.4	22.0	254 52.4	24.7	348 40.4	59.1	187 15.6	15.5
02	40 27.2	200 36.9	23.2	269 53.4	24.3	3 43.1	59.0	202 17.8	15.6
03	55 29.6	215 36.5	24.4	284 54.3	24.0	18 45.8	58.9	217 20.0	15.7
04	70 32.1	230 36.1	25.7	299 55.3	23.6	33 48.5	58.9	232 22.2	15.9
05	85 34.5	245 35.7	26.9	314 56.2	23.3	48 51.2	58.8	247 24.4	16.0
06	100 37.0	260 35.3	S 7 28.1	329 57.1	N19 22.9	63 53.9	N12 58.7	262 26.6	S 5 16.1
07	115 39.5	275 34.9	29.4	344 58.1	22.6	78 56.6	58.6	277 28.7	16.2
08	130 41.9	290 34.5	30.6	359 59.0	22.2	93 59.4	58.5	292 30.9	16.3
S 09	145 44.4	305 34.0	31.8	14 59.9	21.9	109 02.1	58.4	307 33.1	16.4
U 10	160 46.9	320 33.6	33.1	30 00.9	21.5	124 04.8	58.3	322 35.3	16.6
N 11	175 49.3	335 33.2	34.3	45 01.8	21.2	139 07.5	58.3	337 37.5	16.7
D 12	190 51.8	350 32.8	S 7 35.5	60 02.8	N19 20.8	154 10.2	N12 58.2	352 39.7	S 5 16.8
A 13	205 54.3	5 32.4	36.8	75 03.7	20.5	169 12.9	58.1	7 41.8	16.9
Y 14	220 56.7	20 32.0	38.0	90 04.7	20.1	184 15.6	58.0	22 44.0	17.0
15	235 59.2	35 31.5	39.2	105 05.6	19.8	199 18.3	57.9	37 46.2	17.1
16	251 01.7	50 31.1	40.5	120 06.5	19.4	214 21.0	57.8	52 48.4	17.2
17	266 04.1	65 30.7	41.7	135 07.5	19.1	229 23.7	57.7	67 50.6	17.4
18	281 06.6	80 30.3	S 7 42.9	150 08.4	N19 18.7	244 26.5	N12 57.7	82 52.8	S 5 17.5
19	296 09.0	95 29.9	44.2	165 09.4	18.4	259 29.2	57.6	97 54.9	17.6
20	311 11.5	110 29.5	45.4	180 10.3	18.0	274 31.9	57.5	112 57.1	17.7
21	326 14.0	125 29.0	46.6	195 11.2	17.7	289 34.6	57.4	127 59.3	17.8
22	341 16.4	140 28.6	47.8	210 12.2	17.3	304 37.3	57.3	143 01.5	17.9
23	356 18.9	155 28.2	49.1	225 13.1	17.0	319 40.0	57.2	158 03.7	18.1
3 00	11 21.4	170 27.8	S 7 50.3	240 14.1	N19 16.6	334 42.7	N12 57.1	173 05.9	S 5 18.2
01	26 23.8	185 27.4	51.5	255 15.0	16.3	349 45.4	57.1	188 08.0	18.3
02	41 26.3	200 26.9	52.8	270 16.0	15.9	4 48.2	57.0	203 10.2	18.4
03	56 28.8	215 26.5	54.0	285 16.9	15.6	19 50.9	56.9	218 12.4	18.5
04	71 31.2	230 26.1	55.2	300 17.9	15.2	34 53.6	56.8	233 14.6	18.6
05	86 33.7	245 25.7	56.4	315 18.8	14.9	49 56.3	56.7	248 16.8	18.7
06	101 36.2	260 25.3	S 7 57.7	330 19.7	N19 14.5	64 59.0	N12 56.6	263 19.0	S 5 18.9
07	116 38.6	275 24.8	7 58.9	345 20.7	14.2	80 01.7	56.5	278 21.1	19.0
08	131 41.1	290 24.4	8 00.1	0 21.6	13.8	95 04.4	56.5	293 23.3	19.1
M 09	146 43.5	305 24.0	01.3	15 22.6	13.5	110 07.2	56.4	308 25.5	19.2
O 10	161 46.0	320 23.6	02.6	30 23.5	13.1	125 09.9	56.3	323 27.7	19.3
N 11	176 48.5	335 23.1	03.8	45 24.5	12.8	140 12.6	56.2	338 29.9	19.4
D 12	191 50.9	350 22.7	S 8 05.0	60 25.4	N19 12.4	155 15.3	N12 56.1	353 32.1	S 5 19.6
A 13	206 53.4	5 22.3	06.2	75 26.4	12.1	170 18.0	56.0	8 34.2	19.7
Y 14	221 55.9	20 21.9	07.5	90 27.3	11.7	185 20.7	55.9	23 36.4	19.8
15	236 58.3	35 21.5	08.7	105 28.3	11.4	200 23.5	55.8	38 38.6	19.9
16	252 00.8	50 21.0	09.9	120 29.2	11.0	215 26.2	55.8	53 40.8	20.0
17	267 03.3	65 20.6	11.1	135 30.2	10.7	230 28.9	55.7	68 43.0	20.1
18	282 05.7	80 20.2	S 8 12.4	150 31.1	N19 10.3	245 31.6	N12 55.6	83 45.2	S 5 20.2
19	297 08.2	95 19.8	13.6	165 32.1	10.0	260 34.3	55.5	98 47.3	20.4
20	312 10.7	110 19.3	14.8	180 33.0	09.6	275 37.0	55.4	113 49.5	20.5
21	327 13.1	125 18.9	16.0	195 34.0	09.2	290 39.8	55.3	128 51.7	20.6
22	342 15.6	140 18.5	17.3	210 34.9	08.9	305 42.5	55.2	143 53.9	20.7
23	357 18.0	155 18.1	18.5	225 35.9	08.5	320 45.2	55.1	158 56.1	20.8
	h m								
Mer. Pass.	23 14.7	*v* −0.4	*d* 1.2	*v* 0.9	*d* 0.3	*v* 2.7	*d* 0.1	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.9	S40 15.2
Achernar	335 27.0	S57 10.4
Acrux	173 11.4	S63 09.9
Adhara	255 13.5	S28 59.1
Aldebaran	290 50.6	N16 32.0
Alioth	166 22.2	N55 53.8
Alkaid	153 00.3	N49 15.4
Al Na'ir	27 44.8	S46 54.2
Alnilam	275 47.5	S 1 11.6
Alphard	217 57.5	S 8 42.5
Alphecca	126 12.3	N26 40.7
Alpheratz	357 44.4	N29 09.6
Altair	62 09.3	N 8 54.3
Ankaa	353 16.4	S42 14.3
Antares	112 27.9	S26 27.4
Arcturus	145 57.1	N19 07.4
Atria	107 31.1	S69 03.1
Avior	234 18.8	S59 32.6
Bellatrix	278 33.2	N 6 21.7
Betelgeuse	271 02.5	N 7 24.6
Canopus	263 56.7	S52 41.9
Capella	280 36.1	N46 00.4
Deneb	49 32.1	N45 19.7
Denebola	182 35.2	N14 30.4
Diphda	348 56.8	S17 55.1
Dubhe	193 53.7	N61 41.1
Elnath	278 14.0	N28 36.9
Eltanin	90 46.8	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.8
Gienah	175 53.9	S17 36.4
Hadar	148 50.3	S60 25.9
Hamal	328 01.8	N23 31.2
Kaus Aust.	83 45.4	S34 22.7
Kochab	137 20.8	N74 06.6
Markab	13 39.2	N15 16.4
Menkar	314 16.1	N 4 08.3
Menkent	148 09.4	S36 25.7
Miaplacidus	221 40.6	S69 45.8
Mirfak	308 41.7	N49 54.1
Nunki	75 59.8	S26 16.8
Peacock	53 20.8	S56 41.9
Pollux	243 29.3	N27 59.7
Procyon	245 01.1	N 5 11.7
Rasalhague	96 07.7	N12 33.3
Regulus	207 45.0	N11 54.5
Rigel	281 13.1	S 8 11.2
Rigil Kent.	139 54.0	S60 53.1
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.3
Shaula	96 23.7	S37 06.7
Sirius	258 34.8	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.6	S43 28.7
Vega	80 39.8	N38 48.1
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	160 15.5	12 38
Mars	229 29.3	8 00
Jupiter	323 15.5	1 45
Saturn	161 51.2	12 29

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
1 00	182 31.2	S 2 58.0	134 55.1	4.9	S21 11.1	5.4	60.0
01	197 31.4	2 59.0	149 19.0	4.9	21 16.5	5.2	60.0
02	212 31.6	3 00.0	163 42.9	4.8	21 21.7	5.1	60.0
03	227 31.8	00.9	178 06.7	4.9	21 26.8	4.9	59.9
04	242 32.0	01.9	192 30.6	4.9	21 31.7	4.7	59.9
05	257 32.2	02.9	206 54.5	4.9	21 36.4	4.6	59.9
06	272 32.4	S 3 03.8	221 18.4	4.9	S21 41.0	4.5	59.8
07	287 32.6	04.8	235 42.3	4.9	21 45.5	4.3	59.8
08	302 32.8	05.8	250 06.2	4.9	21 49.8	4.1	59.8
09	317 33.0	06.7	264 30.1	4.9	21 53.9	4.0	59.7
10	332 33.2	07.7	278 54.0	4.9	21 57.9	3.8	59.7
11	347 33.4	08.7	293 17.9	4.9	22 01.7	3.7	59.7
12	2 33.6	S 3 09.7	307 41.8	5.0	S22 05.4	3.5	59.6
13	17 33.8	10.6	322 05.8	5.0	22 08.9	3.4	59.6
14	32 34.1	11.6	336 29.8	4.9	22 12.3	3.2	59.6
15	47 34.3	12.6	350 53.7	5.0	22 15.5	3.1	59.5
16	62 34.5	13.5	5 17.7	5.1	22 18.6	2.9	59.5
17	77 34.7	14.5	19 41.8	5.0	22 21.5	2.7	59.5
18	92 34.9	S 3 15.5	34 05.8	5.1	S22 24.2	2.6	59.4
19	107 35.1	16.4	48 29.9	5.1	22 26.8	2.4	59.4
20	122 35.3	17.4	62 54.0	5.1	22 29.2	2.3	59.4
21	137 35.5	18.4	77 18.1	5.2	22 31.5	2.1	59.3
22	152 35.7	19.3	91 42.3	5.2	22 33.6	2.0	59.3
23	167 35.9	20.3	106 06.5	5.2	22 35.6	1.8	59.3
2 00	182 36.1	S 3 21.3	120 30.7	5.2	S22 37.4	1.7	59.2
01	197 36.3	22.3	134 54.9	5.3	22 39.1	1.5	59.2
02	212 36.5	23.2	149 19.2	5.3	22 40.6	1.4	59.1
03	227 36.7	24.2	163 43.5	5.4	22 42.0	1.2	59.1
04	242 36.9	25.2	178 07.9	5.4	22 43.2	1.0	59.1
05	257 37.1	26.1	192 32.3	5.4	22 44.2	0.9	59.0
06	272 37.3	S 3 27.1	206 56.7	5.5	S22 45.1	0.8	59.0
07	287 37.5	28.1	221 21.2	5.5	22 45.9	0.6	59.0
08	302 37.7	29.0	235 45.7	5.6	22 46.5	0.4	58.9
09	317 37.9	30.0	250 10.3	5.6	22 46.9	0.3	58.9
10	332 38.1	31.0	264 34.9	5.6	22 47.2	0.2	58.9
11	347 38.3	31.9	278 59.5	5.8	22 47.4	0.0	58.8
12	2 38.5	S 3 32.9	293 24.3	5.7	S22 47.4	0.2	58.8
13	17 38.7	33.9	307 49.0	5.8	22 47.2	0.3	58.7
14	32 38.9	34.8	322 13.8	5.9	22 46.9	0.4	58.7
15	47 39.0	35.8	336 38.7	5.9	22 46.5	0.6	58.7
16	62 39.2	36.8	351 03.6	6.0	22 45.9	0.7	58.6
17	77 39.4	37.7	5 28.6	6.0	22 45.2	0.9	58.6
18	92 39.6	S 3 38.7	19 53.6	6.1	S22 44.3	1.0	58.6
19	107 39.8	39.7	34 18.7	6.1	22 43.3	1.2	58.5
20	122 40.0	40.6	48 43.8	6.2	22 42.1	1.3	58.5
21	137 40.2	41.6	63 09.0	6.3	22 40.8	1.4	58.4
22	152 40.4	42.6	77 34.3	6.3	22 39.4	1.6	58.4
23	167 40.6	43.6	91 59.6	6.4	22 37.8	1.7	58.4
3 00	182 40.8	S 3 44.5	106 25.0	6.5	S22 36.1	1.9	58.3
01	197 41.0	45.5	120 50.5	6.5	22 34.2	2.0	58.3
02	212 41.2	46.5	135 16.0	6.6	22 32.2	2.1	58.3
03	227 41.4	47.4	149 41.6	6.6	22 30.1	2.3	58.2
04	242 41.6	48.4	164 07.2	6.8	22 27.8	2.4	58.2
05	257 41.8	49.4	178 33.0	6.8	22 25.4	2.6	58.1
06	272 42.0	S 3 50.3	192 58.8	6.8	S22 22.8	2.7	58.1
07	287 42.2	51.3	207 24.6	7.0	22 20.1	2.8	58.1
08	302 42.4	52.3	221 50.6	7.0	22 17.3	2.9	58.0
09	317 42.6	53.2	236 16.6	7.0	22 14.4	3.1	58.0
10	332 42.8	54.2	250 42.6	7.2	22 11.3	3.2	58.0
11	347 43.0	55.2	265 08.8	7.2	22 08.1	3.4	57.9
12	2 43.2	S 3 56.1	279 35.0	7.3	S22 04.7	3.4	57.9
13	17 43.4	57.1	294 01.3	7.4	22 01.3	3.6	57.9
14	32 43.6	58.1	308 27.7	7.5	21 57.7	3.8	57.8
15	47 43.8	3 59.0	322 54.2	7.5	21 53.9	3.8	57.8
16	62 44.0	4 00.0	337 20.7	7.6	21 50.1	4.0	57.7
17	77 44.2	00.9	351 47.3	7.7	21 46.1	4.1	57.7
18	92 44.4	S 4 01.9	6 14.0	7.8	S21 42.0	4.2	57.7
19	107 44.6	02.9	20 40.8	7.8	21 37.8	4.3	57.6
20	122 44.7	03.8	35 07.6	8.0	21 33.5	4.5	57.6
21	137 44.9	04.8	49 34.6	8.0	21 29.0	4.6	57.6
22	152 45.1	05.8	64 01.6	8.1	21 24.4	4.7	57.5
23	167 45.3	06.7	78 28.7	8.2	S21 19.7	4.8	57.5
	SD 16.0	d 1.0	SD 16.3		16.0		15.8

SATURDAY 1 · SUNDAY 2 · MONDAY 3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 1	Moonrise 2	Moonrise 3	Moonrise 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	03 52	05 14	06 21	▬	▬	▬	▬
N 70	04 04	05 17	06 18	▬	▬	▬	17 41
68	04 13	05 19	06 15	▬	▬	17 09	16 35
66	04 21	05 21	06 12	14 04	15 21	15 50	15 59
64	04 27	05 23	06 10	13 22	14 33	15 13	15 33
62	04 32	05 24	06 08	12 53	14 02	14 46	15 13
60	04 37	05 25	06 07	12 31	13 39	14 26	14 56
N 58	04 40	05 26	06 05	12 14	13 20	14 09	14 42
56	04 44	05 27	06 04	11 59	13 04	13 54	14 30
54	04 46	05 28	06 03	11 46	12 51	13 42	14 20
52	04 49	05 28	06 02	11 34	12 39	13 31	14 10
50	04 51	05 29	06 01	11 24	12 29	13 21	14 02
45	04 55	05 29	05 59	11 03	12 07	13 00	13 44
N 40	04 58	05 30	05 57	10 47	11 49	12 44	13 29
35	05 01	05 30	05 55	10 32	11 35	12 29	13 17
30	05 02	05 30	05 54	10 20	11 22	12 17	13 06
20	05 03	05 29	05 51	09 59	11 00	11 56	12 47
N 10	05 03	05 28	05 49	09 41	10 41	11 38	12 31
0	05 01	05 25	05 46	09 24	10 23	11 21	12 15
S 10	04 58	05 23	05 44	09 07	10 06	11 04	12 00
20	04 53	05 19	05 41	08 49	09 47	10 45	11 43
30	04 46	05 14	05 38	08 28	09 25	10 24	11 24
35	04 41	05 10	05 36	08 16	09 12	10 12	11 13
40	04 34	05 06	05 34	08 02	08 58	09 58	11 01
45	04 27	05 01	05 31	07 46	08 40	09 41	10 46
S 50	04 16	04 55	05 28	07 26	08 19	09 20	10 27
52	04 12	04 52	05 26	07 16	08 09	09 10	10 18
54	04 06	04 49	05 25	07 05	07 57	08 59	10 09
56	04 00	04 45	05 23	06 53	07 44	08 46	09 58
58	03 53	04 41	05 21	06 39	07 29	08 32	09 45
S 60	03 44	04 37	05 19	06 23	07 10	08 14	09 30

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 1	Moonset 2	Moonset 3	Moonset 4
°	h m	h m	h m	h m	h m	h m	h m
N 72	17 15	18 22	19 43	▬	▬	▬	▬
N 70	17 19	18 19	19 32	▬	▬	▬	19 26
68	17 22	18 17	19 23	▬	▬	18 05	20 31
66	17 25	18 16	19 16	17 07	17 54	19 24	21 06
64	17 27	18 14	19 10	17 50	18 43	20 01	21 32
62	17 29	18 13	19 05	18 19	19 13	20 27	21 51
60	17 31	18 12	19 01	18 41	19 37	20 48	22 07
N 58	17 32	18 11	18 57	18 59	19 55	21 04	22 21
56	17 34	18 11	18 54	19 14	20 11	21 19	22 33
54	17 35	18 10	18 51	19 27	20 24	21 31	22 43
52	17 36	18 10	18 49	19 38	20 36	21 42	22 52
50	17 37	18 09	18 47	19 49	20 46	21 51	23 00
45	17 40	18 09	18 43	20 10	21 08	22 11	23 17
N 40	17 41	18 08	18 40	20 27	21 25	22 27	23 31
35	17 43	18 08	18 38	20 42	21 40	22 41	23 43
30	17 45	18 09	18 36	20 54	21 53	22 53	23 53
20	17 48	18 10	18 35	21 16	22 15	23 13	24 11
N 10	17 50	18 11	18 36	21 35	22 34	23 31	24 26
0	17 53	18 13	18 37	21 52	22 51	23 47	24 40
S 10	17 55	18 16	18 41	22 10	23 09	24 04	00 04
20	17 58	18 20	18 46	22 28	23 27	24 21	00 21
30	18 02	18 26	18 54	22 50	23 49	24 41	00 41
35	18 04	18 29	18 59	23 03	24 01	00 01	00 52
40	18 06	18 33	19 05	23 17	24 16	00 16	01 06
45	18 09	18 38	19 13	23 34	24 33	00 33	01 21
S 50	18 12	18 45	19 24	23 56	24 54	00 54	01 41
52	18 14	18 48	19 29	24 06	00 06	01 04	01 50
54	18 15	18 51	19 34	24 17	00 17	01 15	02 00
56	18 17	18 55	19 41	24 30	00 30	01 28	02 11
58	18 19	18 59	19 48	24 46	00 46	01 43	02 24
S 60	18 21	19 04	19 57	25 04	01 04	02 01	02 40

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
1	10 04	10 14	11 50	15 38	03 08	04	22
2	10 24	10 33	11 49	16 37	04 08	05	33
3	10 43	10 52	11 49	17 34	05 06	06	43

UT	ARIES	VENUS −3.9		MARS +1.3		JUPITER −2.9		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
4 00	12 20.5	170 17.6	S 8 19.7	240 36.8	N19 08.2	335 47.9	N12 55.1	173 58.3	S 5 20.9
01	27 23.0	185 17.2	20.9	255 37.8	07.8	350 50.6	55.0	189 00.4	21.1
02	42 25.4	200 16.8	22.1	270 38.7	07.5	5 53.4	54.9	204 02.6	21.2
03	57 27.9	215 16.4	. . 23.4	285 39.7	. . 07.1	20 56.1	. . 54.8	219 04.8	. . 21.3
04	72 30.4	230 15.9	24.6	300 40.6	06.8	35 58.8	54.7	234 07.0	21.4
05	87 32.8	245 15.5	25.8	315 41.6	06.4	51 01.5	54.6	249 09.2	21.5
06	102 35.3	260 15.1	S 8 27.0	330 42.5	N19 06.1	66 04.2	N12 54.5	264 11.3	S 5 21.6
07	117 37.8	275 14.6	28.2	345 43.5	05.7	81 07.0	54.4	279 13.5	21.7
08	132 40.2	290 14.2	29.5	0 44.4	05.4	96 09.7	54.3	294 15.7	21.9
T 09	147 42.7	305 13.8	. . 30.7	15 45.4	. . 05.0	111 12.4	. . 54.3	309 17.9	. . 22.0
U 10	162 45.1	320 13.4	31.9	30 46.3	04.6	126 15.1	54.2	324 20.1	22.1
E 11	177 47.6	335 12.9	33.1	45 47.3	04.3	141 17.8	54.1	339 22.3	22.2
S 12	192 50.1	350 12.5	S 8 34.3	60 48.2	N19 03.9	156 20.6	N12 54.0	354 24.4	S 5 22.3
D 13	207 52.5	5 12.1	35.5	75 49.2	03.6	171 23.3	53.9	9 26.6	22.4
A 14	222 55.0	20 11.6	36.8	90 50.1	03.2	186 26.0	53.8	24 28.8	22.6
Y 15	237 57.5	35 11.2	. . 38.0	105 51.1	. . 02.9	201 28.7	. . 53.7	39 31.0	. . 22.7
16	252 59.9	50 10.8	39.2	120 52.1	02.5	216 31.4	53.6	54 33.2	22.8
17	268 02.4	65 10.3	40.4	135 53.0	02.2	231 34.2	53.5	69 35.4	22.9
18	283 04.9	80 09.9	S 8 41.6	150 54.0	N19 01.8	246 36.9	N12 53.5	84 37.5	S 5 23.0
19	298 07.3	95 09.5	42.8	165 54.9	01.4	261 39.6	53.4	99 39.7	23.1
20	313 09.8	110 09.0	44.1	180 55.9	01.1	276 42.3	53.3	114 41.9	23.2
21	328 12.3	125 08.6	. . 45.3	195 56.8	. . 00.7	291 45.1	. . 53.2	129 44.1	. . 23.4
22	343 14.7	140 08.2	46.5	210 57.8	00.4	306 47.8	53.1	144 46.3	23.5
23	358 17.2	155 07.7	47.7	225 58.8	19 00.0	321 50.5	53.0	159 48.4	23.6
5 00	13 19.6	170 07.3	S 8 48.9	240 59.7	N18 59.7	336 53.2	N12 52.9	174 50.6	S 5 23.7
01	28 22.1	185 06.9	50.1	256 00.7	59.3	351 56.0	52.8	189 52.8	23.8
02	43 24.6	200 06.4	51.3	271 01.6	58.9	6 58.7	52.7	204 55.0	23.9
03	58 27.0	215 06.0	. . 52.6	286 02.6	. . 58.6	22 01.4	. . 52.7	219 57.2	. . 24.1
04	73 29.5	230 05.6	53.8	301 03.5	58.2	37 04.1	52.6	234 59.4	24.2
05	88 32.0	245 05.1	55.0	316 04.5	57.9	52 06.9	52.5	250 01.5	24.3
06	103 34.4	260 04.7	S 8 56.2	331 05.5	N18 57.5	67 09.6	N12 52.4	265 03.7	S 5 24.4
W 07	118 36.9	275 04.3	57.4	346 06.4	57.2	82 12.3	52.3	280 05.9	24.5
E 08	133 39.4	290 03.8	58.6	1 07.4	56.8	97 15.0	52.2	295 08.1	24.6
D 09	148 41.8	305 03.4	8 59.8	16 08.3	. . 56.4	112 17.8	. . 52.1	310 10.3	. . 24.7
N 10	163 44.3	320 03.0	9 01.0	31 09.3	56.1	127 20.5	52.0	325 12.5	24.9
E 11	178 46.8	335 02.5	02.2	46 10.3	55.7	142 23.2	51.9	340 14.6	25.0
S 12	193 49.2	350 02.1	S 9 03.5	61 11.2	N18 55.4	157 25.9	N12 51.8	355 16.8	S 5 25.1
D 13	208 51.7	5 01.7	04.7	76 12.2	55.0	172 28.7	51.8	10 19.0	25.2
A 14	223 54.1	20 01.2	05.9	91 13.1	54.6	187 31.4	51.7	25 21.2	25.3
Y 15	238 56.6	35 00.8	. . 07.1	106 14.1	. . 54.3	202 34.1	. . 51.6	40 23.4	. . 25.4
16	253 59.1	50 00.3	08.3	121 15.1	53.9	217 36.8	51.5	55 25.5	25.5
17	269 01.5	64 59.9	09.5	136 16.0	53.6	232 39.6	51.4	70 27.7	25.7
18	284 04.0	79 59.5	S 9 10.7	151 17.0	N18 53.2	247 42.3	N12 51.3	85 29.9	S 5 25.8
19	299 06.5	94 59.0	11.9	166 18.0	52.8	262 45.0	51.2	100 32.1	25.9
20	314 08.9	109 58.6	13.1	181 18.9	52.5	277 47.8	51.1	115 34.3	26.0
21	329 11.4	124 58.1	. . 14.3	196 19.9	. . 52.1	292 50.5	. . 51.0	130 36.5	. . 26.1
22	344 13.9	139 57.7	15.5	211 20.8	51.8	307 53.2	50.9	145 38.6	26.2
23	359 16.3	154 57.3	16.7	226 21.8	51.4	322 55.9	50.8	160 40.8	26.4
6 00	14 18.8	169 56.8	S 9 17.9	241 22.8	N18 51.0	337 58.7	N12 50.8	175 43.0	S 5 26.5
01	29 21.2	184 56.4	19.1	256 23.7	50.7	353 01.4	50.7	190 45.2	26.6
02	44 23.7	199 55.9	20.3	271 24.7	50.3	8 04.1	50.6	205 47.4	26.7
03	59 26.2	214 55.5	. . 21.6	286 25.7	. . 50.0	23 06.9	. . 50.5	220 49.5	. . 26.8
04	74 28.6	229 55.1	22.8	301 26.6	49.6	38 09.6	50.4	235 51.7	26.9
05	89 31.1	244 54.6	24.0	316 27.6	49.2	53 12.3	50.3	250 53.9	27.0
06	104 33.6	259 54.2	S 9 25.2	331 28.6	N18 48.9	68 15.1	N12 50.2	265 56.1	S 5 27.2
07	119 36.0	274 53.7	26.4	346 29.5	48.5	83 17.8	50.1	280 58.3	27.3
T 08	134 38.5	289 53.3	27.6	1 30.5	48.2	98 20.5	50.0	296 00.5	27.4
H 09	149 41.0	304 52.8	. . 28.8	16 31.5	. . 47.8	113 23.3	. . 49.9	311 02.6	. . 27.5
U 10	164 43.4	319 52.4	30.0	31 32.4	47.4	128 26.0	49.8	326 04.8	27.6
R 11	179 45.9	334 52.0	31.2	46 33.4	47.1	143 28.7	49.7	341 07.0	27.7
S 12	194 48.4	349 51.5	S 9 32.4	61 34.4	N18 46.7	158 31.4	N12 49.7	356 09.2	S 5 27.9
D 13	209 50.8	4 51.1	33.6	76 35.3	46.4	173 34.2	49.6	11 11.4	28.0
A 14	224 53.3	19 50.6	34.8	91 36.3	46.0	188 36.9	49.5	26 13.5	28.1
Y 15	239 55.7	34 50.2	. . 36.0	106 37.3	. . 45.6	203 39.6	. . 49.4	41 15.7	. . 28.2
16	254 58.2	49 49.7	37.2	121 38.2	45.3	218 42.4	49.3	56 17.9	28.3
17	270 00.7	64 49.3	38.4	136 39.2	44.9	233 45.1	49.2	71 20.1	28.4
18	285 03.1	79 48.8	S 9 39.6	151 40.2	N18 44.5	248 47.8	N12 49.1	86 22.3	S 5 28.5
19	300 05.6	94 48.4	40.8	166 41.1	44.2	263 50.6	49.0	101 24.5	28.7
20	315 08.1	109 47.9	42.0	181 42.1	43.8	278 53.3	48.9	116 26.6	28.8
21	330 10.5	124 47.5	. . 43.2	196 43.1	. . 43.5	293 56.0	. . 48.8	131 28.8	. . 28.9
22	345 13.0	139 47.0	44.4	211 44.1	43.1	308 58.8	48.7	146 31.0	29.0
23	0 15.5	154 46.6	45.6	226 45.0	42.7	324 01.5	48.6	161 33.2	29.1
	h m								
Mer. Pass.	23 02.9	*v* −0.4	*d* 1.2	*v* 1.0	*d* 0.4	*v* 2.7	*d* 0.1	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.9	S40 15.2
Achernar	335 27.0	S57 10.4
Acrux	173 11.4	S63 09.9
Adhara	255 13.5	S28 59.1
Aldebaran	290 50.6	N16 32.0
Alioth	166 22.2	N55 53.7
Alkaid	153 00.3	N49 15.3
Al Na'ir	27 44.8	S46 54.2
Alnilam	275 47.5	S 1 11.6
Alphard	217 57.5	S 8 42.5
Alphecca	126 12.3	N26 40.7
Alpheratz	357 44.4	N29 09.6
Altair	62 09.3	N 8 54.3
Ankaa	353 16.4	S42 14.4
Antares	112 27.9	S26 27.4
Arcturus	145 57.1	N19 07.4
Atria	107 31.1	S69 03.1
Avior	234 18.8	S59 32.6
Bellatrix	278 33.2	N 6 21.7
Betelgeuse	271 02.5	N 7 24.6
Canopus	263 56.6	S52 41.9
Capella	280 36.0	N46 00.4
Deneb	49 32.1	N45 19.7
Denebola	182 35.2	N14 30.4
Diphda	348 56.7	S17 55.1
Dubhe	193 53.7	N61 41.1
Elnath	278 14.0	N28 37.0
Eltanin	90 46.8	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.7
Gienah	175 53.9	S17 36.4
Hadar	148 50.3	S60 25.8
Hamal	328 01.8	N23 31.2
Kaus Aust.	83 45.4	S34 22.7
Kochab	137 20.8	N74 06.6
Markab	13 39.2	N15 16.4
Menkar	314 16.0	N 4 08.3
Menkent	148 09.4	S36 25.7
Miaplacidus	221 40.5	S69 45.8
Mirfak	308 41.7	N49 54.1
Nunki	75 59.8	S26 16.8
Peacock	53 20.9	S56 41.9
Pollux	243 29.3	N27 59.7
Procyon	245 01.0	N 5 11.7
Rasalhague	96 07.7	N12 33.3
Regulus	207 45.0	N11 54.5
Rigel	281 13.1	S 8 11.2
Rigil Kent.	139 54.0	S60 53.1
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.3
Shaula	96 23.7	S37 06.7
Sirius	258 34.8	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.6	S43 28.6
Vega	80 39.8	N38 48.1
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	156 47.7	12 40
Mars	227 40.1	7 56
Jupiter	323 33.6	1 32
Saturn	161 31.0	12 19

UT	SUN			MOON					Lat.	Twilight		Sunrise	Moonrise			
		GHA	Dec	GHA	v	Dec	d	HP		Naut.	Civil		4	5	6	7
d h		° ′	° ′	° ′	′	° ′	′	′	°	h m	h m	h m	h m	h m	h m	h m
4 00		182 45.5	S 4 07.7	92 55.9	8.2	S21 14.9	4.9	57.5	N 72	04 07	05 28	06 35		17 38	16 57	16 33
01		197 45.7	08.7	107 23.1	8.4	21 10.0	5.1	57.4	N 70	04 17	05 29	06 30	17 41	16 54	16 34	16 20
02		212 45.9	09.6	121 50.5	8.4	21 04.9	5.1	57.4	68	04 25	05 30	06 26	16 35	16 24	16 16	16 10
03		227 46.1	. . 10.6	136 17.9	8.5	20 59.8	5.3	57.4	66	04 31	05 31	06 22	15 59	16 02	16 02	16 01
04		242 46.3	11.6	150 45.4	8.6	20 54.5	5.4	57.3	64	04 36	05 32	06 19	15 33	15 44	15 50	15 54
05		257 46.5	12.5	165 13.0	8.7	20 49.1	5.5	57.3	62	04 40	05 32	06 16	15 13	15 29	15 40	15 47
06		272 46.7	S 4 13.5	179 40.7	8.7	S20 43.6	5.6	57.2	60	04 44	05 32	06 14	14 56	15 17	15 31	15 42
07		287 46.9	14.5	194 08.4	8.9	20 38.0	5.7	57.2	N 58	04 47	05 33	06 12	14 42	15 06	15 23	15 37
08		302 47.1	15.4	208 36.3	8.9	20 32.3	5.8	57.2	56	04 50	05 33	06 10	14 30	14 56	15 16	15 33
09		317 47.3	. . 16.4	223 04.2	9.0	20 26.5	6.0	57.1	54	04 52	05 33	06 08	14 20	14 48	15 10	15 29
10		332 47.5	17.4	237 32.2	9.1	20 20.5	6.0	57.1	52	04 54	05 33	06 07	14 10	14 41	15 05	15 25
11		347 47.7	18.3	252 00.3	9.2	20 14.5	6.1	57.1	50	04 56	05 33	06 05	14 02	14 34	15 00	15 22
12		2 47.8	S 4 19.3	266 28.5	9.3	S20 08.4	6.3	57.0	45	04 59	05 33	06 02	13 44	14 19	14 49	15 15
13		17 48.0	20.2	280 56.8	9.3	20 02.1	6.3	57.0	N 40	05 01	05 33	06 00	13 29	14 07	14 40	15 09
14		32 48.2	21.2	295 25.1	9.5	19 55.8	6.4	57.0	35	05 03	05 32	05 57	13 17	13 57	14 32	15 04
15		47 48.4	. . 22.2	309 53.6	9.5	19 49.4	6.6	56.9	30	05 04	05 31	05 55	13 06	13 48	14 25	14 59
16		62 48.6	23.1	324 22.1	9.6	19 42.8	6.6	56.9	20	05 04	05 30	05 52	12 47	13 32	14 14	14 51
17		77 48.8	24.1	338 50.7	9.7	19 36.2	6.8	56.9	N 10	05 03	05 27	05 48	12 31	13 19	14 03	14 45
18		92 49.0	S 4 25.1	353 19.4	9.8	S19 29.4	6.8	56.8	0	05 00	05 25	05 45	12 15	13 06	13 53	14 38
19		107 49.2	26.0	7 48.2	9.9	19 22.6	6.9	56.8	S 10	04 56	05 21	05 42	12 00	12 53	13 44	14 32
20		122 49.4	27.0	22 17.1	9.9	19 15.7	7.0	56.8	20	04 50	05 16	05 38	11 43	12 39	13 33	14 25
21		137 49.6	. . 28.0	36 46.0	10.0	19 08.7	7.2	56.7	30	04 42	05 10	05 34	11 24	12 24	13 21	14 17
22		152 49.8	28.9	51 15.0	10.2	19 01.5	7.2	56.7	35	04 36	05 06	05 32	11 13	12 14	13 14	14 12
23		167 50.0	29.9	65 44.2	10.2	18 54.3	7.3	56.7	40	04 29	05 01	05 29	11 01	12 04	13 06	14 07
5 00		182 50.1	S 4 30.8	80 13.4	10.3	S18 47.0	7.4	56.7	45	04 20	04 56	05 25	10 46	11 51	12 57	14 01
01		197 50.3	31.8	94 42.7	10.3	18 39.6	7.4	56.6	S 50	04 09	04 49	05 21	10 27	11 36	12 45	13 53
02		212 50.5	32.8	109 12.0	10.5	18 32.2	7.6	56.6	52	04 04	04 45	05 19	10 18	11 29	12 40	13 50
03		227 50.7	. . 33.7	123 41.5	10.5	18 24.6	7.7	56.6	54	03 58	04 41	05 17	10 09	11 21	12 34	13 46
04		242 50.9	34.7	138 11.0	10.7	18 16.9	7.7	56.5	56	03 51	04 37	05 15	09 58	11 13	12 28	13 42
05		257 51.1	35.7	152 40.7	10.7	18 09.2	7.8	56.5	58	03 43	04 32	05 13	09 45	11 03	12 21	13 37
06		272 51.3	S 4 36.6	167 10.4	10.8	S18 01.4	7.9	56.5	S 60	03 34	04 27	05 10	09 30	10 51	12 12	13 32
07		287 51.5	37.6	181 40.2	10.9	17 53.5	8.0	56.4								
08		302 51.7	38.5	196 10.1	10.9	17 45.5	8.1	56.4								
09		317 51.9	. . 39.5	210 40.0	11.1	17 37.4	8.1	56.4								
10		332 52.0	40.5	225 10.1	11.1	17 29.3	8.2	56.3								
11		347 52.2	41.4	239 40.2	11.2	17 21.1	8.3	56.3								
12		2 52.4	S 4 42.4	254 10.4	11.3	S17 12.8	8.4	56.3								
13		17 52.6	43.4	268 40.7	11.3	17 04.4	8.5	56.3								
14		32 52.8	44.3	283 11.0	11.5	16 55.9	8.5	56.2								
15		47 53.0	. . 45.3	297 41.5	11.5	16 47.4	8.6	56.2								
16		62 53.2	46.2	312 12.0	11.6	16 38.8	8.7	56.2								
17		77 53.4	47.2	326 42.6	11.7	16 30.1	8.8	56.1								
18		92 53.5	S 4 48.2	341 13.3	11.7	S16 21.3	8.8	56.1								
19		107 53.7	49.1	355 44.0	11.9	16 12.5	8.9	56.1								
20		122 53.9	50.1	10 14.9	11.9	16 03.6	8.9	56.1								
21		137 54.1	. . 51.0	24 45.8	12.0	15 54.7	9.0	56.0								
22		152 54.3	52.0	39 16.8	12.1	15 45.7	9.1	56.0								
23		167 54.5	53.0	53 47.9	12.1	15 36.6	9.2	56.0								
6 00		182 54.7	S 4 53.9	68 19.0	12.2	S15 27.4	9.2	55.9								
01		197 54.9	54.9	82 50.2	12.3	15 18.2	9.3	55.9								
02		212 55.0	55.9	97 21.5	12.4	15 08.9	9.4	55.9								
03		227 55.2	. . 56.8	111 52.9	12.4	14 59.5	9.4	55.9								
04		242 55.4	57.8	126 24.3	12.5	14 50.1	9.4	55.8								
05		257 55.6	58.7	140 55.8	12.6	14 40.7	9.6	55.8								
06		272 55.8	S 4 59.7	155 27.4	12.7	S14 31.1	9.6	55.8								
07		287 56.0	5 00.7	169 59.1	12.7	14 21.5	9.6	55.8								
08		302 56.2	01.6	184 30.8	12.8	14 11.9	9.7	55.7								
09		317 56.3	. . 02.6	199 02.6	12.9	14 02.2	9.8	55.7								
10		332 56.5	03.5	213 34.5	12.9	13 52.4	9.8	55.7								
11		347 56.7	04.5	228 06.4	13.0	13 42.6	9.9	55.7								
12		2 56.9	S 5 05.4	242 38.4	13.1	S13 32.7	9.9	55.6								
13		17 57.1	06.4	257 10.5	13.1	13 22.8	9.9	55.6								
14		32 57.3	07.4	271 42.6	13.2	13 12.9	10.1	55.6								
15		47 57.5	. . 08.3	286 14.8	13.3	13 02.8	10.0	55.6								
16		62 57.6	09.3	300 47.1	13.3	12 52.8	10.2	55.5								
17		77 57.8	10.2	315 19.4	13.4	12 42.6	10.1	55.5								
18		92 58.0	S 5 11.2	329 51.8	13.4	S12 32.5	10.3	55.5								
19		107 58.2	12.2	344 24.2	13.6	12 22.2	10.2	55.5								
20		122 58.4	13.1	358 56.8	13.5	12 12.0	10.3	55.4								
21		137 58.6	. . 14.1	13 29.3	13.7	12 01.7	10.4	55.4								
22		152 58.7	15.0	28 02.0	13.7	11 51.3	10.4	55.4								
23		167 58.9	16.0	42 34.7	13.7	S11 40.9	10.4	55.4								
		SD 16.0	d 1.0	SD	15.5		15.3									

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	4	5	6	7
°	h m	h m	h m	h m	h m	h m	h m
N 72	17 00	18 07	19 27		21 14	23 32	25 28
N 70	17 05	18 06	19 17	19 26	21 57	23 53	25 39
68	17 10	18 05	19 10	20 31	22 26	24 10	00 10
66	17 13	18 04	19 04	21 06	22 47	24 23	00 23
64	17 17	18 04	18 59	21 32	23 04	24 34	00 34
62	17 19	18 03	18 55	21 51	23 18	24 43	00 43
60	17 22	18 03	18 51	22 07	23 30	24 51	00 51
N 58	17 24	18 03	18 48	22 21	23 40	24 58	00 58
56	17 26	18 03	18 46	22 33	23 48	25 04	01 04
54	17 28	18 03	18 44	22 43	23 56	25 09	01 09
52	17 29	18 03	18 42	22 52	24 03	00 03	01 14
50	17 31	18 03	18 40	23 00	24 09	00 09	01 18
45	17 34	18 03	18 37	23 17	24 23	00 23	01 28
N 40	17 37	18 04	18 35	23 31	24 34	00 34	01 35
35	17 39	18 04	18 34	23 43	24 43	00 43	01 42
30	17 41	18 05	18 33	23 53	24 51	00 51	01 48
20	17 45	18 07	18 33	24 11	00 11	01 05	01 58
N 10	17 48	18 09	18 34	24 26	00 26	01 18	02 07
0	17 52	18 13	18 37	24 40	00 40	01 29	02 15
S 10	17 55	18 16	18 41	00 04	00 54	01 40	02 23
20	17 59	18 21	18 47	00 21	01 09	01 52	02 32
30	18 03	18 28	18 56	00 41	01 26	02 06	02 42
35	18 06	18 32	19 02	00 52	01 36	02 14	02 47
40	18 09	18 36	19 09	01 06	01 48	02 23	02 54
45	18 12	18 42	19 18	01 21	02 01	02 33	03 01
S 50	18 17	18 50	19 29	01 41	02 17	02 46	03 10
52	18 19	18 53	19 35	01 50	02 24	02 52	03 14
54	18 21	18 57	19 41	02 00	02 33	02 58	03 18
56	18 23	19 01	19 48	02 11	02 42	03 05	03 23
58	18 26	19 06	19 56	02 24	02 53	03 13	03 29
S 60	18 29	19 12	20 06	02 40	03 05	03 22	03 35

Day	SUN		Mer.	MOON			
	Eqn. of Time		Pass.	Mer. Pass.		Age	Phase
	00h	12h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
4	11 02	11 11	11 49	18 28	06 01	07	54
5	11 20	11 29	11 49	19 18	06 53	08	64
6	11 38	11 47	11 48	20 04	07 41	09	73

TUESDAY

WEDNESDAY

THURSDAY

UT	ARIES	VENUS −3.9		MARS +1.3		JUPITER −2.9		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
7 00	15 17.9	169 46.2	S 9 46.8	241 46.0	N18 42.4	339 04.3	N12 48.5	176 35.4	S 5 29.2
01	30 20.4	184 45.7	47.9	256 47.0	42.0	354 07.0	48.5	191 37.5	29.4
02	45 22.9	199 45.3	49.1	271 47.9	41.6	9 09.7	48.4	206 39.7	29.5
03	60 25.3	214 44.8	50.3	286 48.9	41.3	24 12.5	48.3	221 41.9	29.6
04	75 27.8	229 44.4	51.5	301 49.9	40.9	39 15.2	48.2	236 44.1	29.7
05	90 30.2	244 43.9	52.7	316 50.9	40.5	54 17.9	48.1	251 46.3	29.8
06	105 32.7	259 43.5	S 9 53.9	331 51.8	N18 40.2	69 20.7	N12 48.0	266 48.4	S 5 29.9
07	120 35.2	274 43.0	55.1	346 52.8	39.8	84 23.4	47.9	281 50.6	30.0
08	135 37.6	289 42.6	56.3	1 53.8	39.4	99 26.1	47.8	296 52.8	30.2
F 09	150 40.1	304 42.1	57.5	16 54.8	39.1	114 28.9	47.7	311 55.0	30.3
R 10	165 42.6	319 41.6	58.7	31 55.7	38.7	129 31.6	47.6	326 57.2	30.4
I 11	180 45.0	334 41.2	9 59.9	46 56.7	38.4	144 34.3	47.5	341 59.4	30.5
D 12	195 47.5	349 40.7	S10 01.1	61 57.7	N18 38.0	159 37.1	N12 47.4	357 01.5	S 5 30.6
A 13	210 50.0	4 40.3	02.3	76 58.7	37.6	174 39.8	47.3	12 03.7	30.7
Y 14	225 52.4	19 39.8	03.5	91 59.6	37.3	189 42.6	47.2	27 05.9	30.8
15	240 54.9	34 39.4	04.7	107 00.6	36.9	204 45.3	47.1	42 08.1	31.0
16	255 57.3	49 38.9	05.8	122 01.6	36.5	219 48.0	47.0	57 10.3	31.1
17	270 59.8	64 38.5	07.0	137 02.6	36.2	234 50.8	47.0	72 12.4	31.2
18	286 02.3	79 38.0	S10 08.2	152 03.5	N18 35.8	249 53.5	N12 46.9	87 14.6	S 5 31.3
19	301 04.7	94 37.6	09.4	167 04.5	35.4	264 56.2	46.8	102 16.8	31.4
20	316 07.2	109 37.1	10.6	182 05.5	35.1	279 59.0	46.7	117 19.0	31.5
21	331 09.7	124 36.7	11.8	197 06.5	34.7	295 01.7	46.6	132 21.2	31.7
22	346 12.1	139 36.2	13.0	212 07.4	34.3	310 04.5	46.5	147 23.3	31.8
23	1 14.6	154 35.7	14.2	227 08.4	34.0	325 07.2	46.4	162 25.5	31.9
8 00	16 17.1	169 35.3	S10 15.3	242 09.4	N18 33.6	340 09.9	N12 46.3	177 27.7	S 5 32.0
01	31 19.5	184 34.8	16.5	257 10.4	33.2	355 12.7	46.2	192 29.9	32.1
02	46 22.0	199 34.4	17.7	272 11.4	32.9	10 15.4	46.1	207 32.1	32.2
03	61 24.5	214 33.9	18.9	287 12.3	32.5	25 18.2	46.0	222 34.2	32.3
04	76 26.9	229 33.5	20.1	302 13.3	32.1	40 20.9	45.9	237 36.4	32.5
05	91 29.4	244 33.0	21.3	317 14.3	31.8	55 23.6	45.8	252 38.6	32.6
06	106 31.8	259 32.5	S10 22.5	332 15.3	N18 31.4	70 26.4	N12 45.7	267 40.8	S 5 32.7
07	121 34.3	274 32.1	23.6	347 16.2	31.0	85 29.1	45.6	282 43.0	32.8
S 08	136 36.8	289 31.6	24.8	2 17.2	30.7	100 31.9	45.5	297 45.2	32.9
A 09	151 39.2	304 31.2	26.0	17 18.2	30.3	115 34.6	45.4	312 47.3	33.0
T 10	166 41.7	319 30.7	27.2	32 19.2	29.9	130 37.3	45.4	327 49.5	33.1
U 11	181 44.2	334 30.2	28.4	47 20.2	29.6	145 40.1	45.3	342 51.7	33.3
R 12	196 46.6	349 29.8	S10 29.6	62 21.2	N18 29.2	160 42.8	N12 45.2	357 53.9	S 5 33.4
D 13	211 49.1	4 29.3	30.7	77 22.1	28.8	175 45.6	45.1	12 56.1	33.5
A 14	226 51.6	19 28.9	31.9	92 23.1	28.5	190 48.3	45.0	27 58.2	33.6
Y 15	241 54.0	34 28.4	33.1	107 24.1	28.1	205 51.1	44.9	43 00.4	33.7
16	256 56.5	49 27.9	34.3	122 25.1	27.7	220 53.8	44.8	58 02.6	33.8
17	271 58.9	64 27.5	35.5	137 26.1	27.4	235 56.5	44.7	73 04.8	34.0
18	287 01.4	79 27.0	S10 36.6	152 27.0	N18 27.0	250 59.3	N12 44.6	88 07.0	S 5 34.1
19	302 03.9	94 26.5	37.8	167 28.0	26.6	266 02.0	44.5	103 09.1	34.2
20	317 06.3	109 26.1	39.0	182 29.0	26.2	281 04.8	44.4	118 11.3	34.3
21	332 08.8	124 25.6	40.2	197 30.0	25.9	296 07.5	44.3	133 13.5	34.4
22	347 11.3	139 25.1	41.4	212 31.0	25.5	311 10.3	44.2	148 15.7	34.5
23	2 13.7	154 24.7	42.5	227 32.0	25.1	326 13.0	44.1	163 17.9	34.6
9 00	17 16.2	169 24.2	S10 43.7	242 33.0	N18 24.8	341 15.7	N12 44.0	178 20.0	S 5 34.8
01	32 18.7	184 23.7	44.9	257 33.9	24.4	356 18.5	43.9	193 22.2	34.9
02	47 21.1	199 23.3	46.1	272 34.9	24.0	11 21.2	43.8	208 24.4	35.0
03	62 23.6	214 22.8	47.2	287 35.9	23.7	26 24.0	43.7	223 26.6	35.1
04	77 26.1	229 22.3	48.4	302 36.9	23.3	41 26.7	43.6	238 28.8	35.2
05	92 28.5	244 21.9	49.6	317 37.9	22.9	56 29.5	43.5	253 31.0	35.3
06	107 31.0	259 21.4	S10 50.8	332 38.9	N18 22.6	71 32.2	N12 43.4	268 33.1	S 5 35.4
07	122 33.4	274 20.9	51.9	347 39.9	22.2	86 35.0	43.3	283 35.3	35.6
08	137 35.9	289 20.5	53.1	2 40.8	21.8	101 37.7	43.2	298 37.5	35.7
S 09	152 38.4	304 20.0	54.3	17 41.8	21.4	116 40.5	43.1	313 39.7	35.8
U 10	167 40.8	319 19.5	55.5	32 42.8	21.1	131 43.2	43.1	328 41.9	35.9
N 11	182 43.3	334 19.1	56.6	47 43.8	20.7	146 45.9	43.0	343 44.0	36.0
D 12	197 45.8	349 18.6	S10 57.8	62 44.8	N18 20.3	161 48.7	N12 42.9	358 46.2	S 5 36.1
A 13	212 48.2	4 18.1	10 59.0	77 45.8	20.0	176 51.4	42.8	13 48.4	36.2
Y 14	227 50.7	19 17.7	11 00.1	92 46.8	19.6	191 54.2	42.7	28 50.6	36.4
15	242 53.2	34 17.2	01.3	107 47.8	19.2	206 56.9	42.6	43 52.8	36.5
16	257 55.6	49 16.7	02.5	122 48.7	18.8	221 59.7	42.5	58 54.9	36.6
17	272 58.1	64 16.2	03.7	137 49.7	18.5	237 02.4	42.4	73 57.1	36.7
18	288 00.5	79 15.8	S11 04.8	152 50.7	N18 18.1	252 05.2	N12 42.3	88 59.3	S 5 36.8
19	303 03.0	94 15.3	06.0	167 51.7	17.7	267 07.9	42.2	104 01.5	36.9
20	318 05.5	109 14.8	07.2	182 52.7	17.4	282 10.7	42.1	119 03.7	37.1
21	333 07.9	124 14.4	08.3	197 53.7	17.0	297 13.4	42.0	134 05.8	37.2
22	348 10.4	139 13.9	09.5	212 54.7	16.6	312 16.2	41.9	149 08.0	37.3
23	3 12.9	154 13.4	10.7	227 55.7	16.2	327 18.9	41.8	164 10.2	37.4
	h m								
Mer. Pass.	22 51.1	v −0.5	d 1.2	v 1.0	d 0.4	v 2.7	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.9	S40 15.2
Achernar	335 27.0	S57 10.4
Acrux	173 11.4	S63 09.9
Adhara	255 13.5	S28 59.1
Aldebaran	290 50.6	N16 32.0
Alioth	166 22.2	N55 53.7
Alkaid	153 00.3	N49 15.3
Al Na'ir	27 44.8	S46 54.2
Alnilam	275 47.5	S 1 11.6
Alphard	217 57.5	S 8 42.5
Alphecca	126 12.3	N26 40.7
Alpheratz	357 44.4	N29 09.6
Altair	62 09.3	N 8 54.3
Ankaa	353 16.4	S42 14.4
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.4
Atria	107 31.2	S69 03.1
Avior	234 18.8	S59 32.6
Bellatrix	278 33.2	N 6 21.7
Betelgeuse	271 02.5	N 7 24.6
Canopus	263 56.6	S52 41.9
Capella	280 36.0	N46 00.4
Deneb	49 32.1	N45 19.8
Denebola	182 35.2	N14 30.4
Diphda	348 56.7	S17 55.1
Dubhe	193 53.6	N61 41.0
Elnath	278 14.0	N28 37.0
Eltanin	90 46.8	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.7
Gienah	175 53.9	S17 36.4
Hadar	148 50.3	S60 25.8
Hamal	328 01.8	N23 31.2
Kaus Aust.	83 45.5	S34 22.7
Kochab	137 20.9	N74 06.5
Markab	13 39.3	N15 16.4
Menkar	314 16.0	N 4 08.3
Menkent	148 09.4	S36 25.7
Miaplacidus	221 40.5	S69 45.7
Mirfak	308 41.7	N49 54.1
Nunki	75 59.8	S26 16.8
Peacock	53 20.9	S56 41.9
Pollux	243 29.2	N27 59.7
Procyon	245 01.0	N 5 11.7
Rasalhague	96 07.7	N12 33.3
Regulus	207 45.0	N11 54.5
Rigel	281 13.1	S 8 11.2
Rigil Kent.	139 54.0	S60 53.1
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.3
Shaula	96 23.7	S37 06.7
Sirius	258 34.7	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.6	S43 28.6
Vega	80 39.8	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	153 18.2	12 42
Mars	225 52.3	7 51
Jupiter	323 52.9	1 19
Saturn	161 10.6	12 08

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
7 00	182 59.1	S 5 17.0	57 07.4	13.9	S11 30.5	10.5	55.3
01	197 59.3	17.9	71 40.3	13.8	11 20.0	10.6	55.3
02	212 59.5	18.9	86 13.1	14.0	11 09.4	10.5	55.3
03	227 59.7	. . 19.8	100 46.1	14.0	10 58.9	10.6	55.3
04	242 59.8	20.8	115 19.1	14.0	10 48.3	10.7	55.3
05	258 00.0	21.7	129 52.1	14.1	10 37.6	10.7	55.2
06	273 00.2	S 5 22.7	144 25.2	14.2	S10 26.9	10.7	55.2
07	288 00.4	23.7	158 58.4	14.2	10 16.2	10.7	55.2
08	303 00.6	24.6	173 31.6	14.2	10 05.5	10.8	55.2
F 09	318 00.8	. . 25.6	188 04.8	14.3	9 54.7	10.9	55.1
R 10	333 00.9	26.5	202 38.1	14.4	9 43.8	10.8	55.1
I 11	348 01.1	27.5	217 11.5	14.4	9 33.0	10.9	55.1
D 12	3 01.3	S 5 28.4	231 44.9	14.5	S 9 22.1	10.9	55.1
A 13	18 01.5	29.4	246 18.4	14.5	9 11.2	11.0	55.1
Y 14	33 01.7	30.3	260 51.9	14.5	9 00.2	11.0	55.0
15	48 01.8	. . 31.3	275 25.4	14.6	8 49.2	11.0	55.0
16	63 02.0	32.3	289 59.0	14.7	8 38.2	11.0	55.0
17	78 02.2	33.2	304 32.7	14.7	8 27.2	11.1	55.0
18	93 02.4	S 5 34.2	319 06.4	14.7	S 8 16.1	11.1	55.0
19	108 02.6	35.1	333 40.1	14.8	8 05.0	11.2	55.0
20	123 02.7	36.1	348 13.9	14.8	7 53.8	11.1	54.9
21	138 02.9	. . 37.0	2 47.7	14.9	7 42.7	11.2	54.9
22	153 03.1	38.0	17 21.6	14.9	7 31.5	11.2	54.9
23	168 03.3	38.9	31 55.5	14.9	7 20.3	11.2	54.9
8 00	183 03.5	S 5 39.9	46 29.4	15.0	S 7 09.1	11.3	54.9
01	198 03.6	40.9	61 03.4	15.0	6 57.8	11.2	54.8
02	213 03.8	41.8	75 37.4	15.1	6 46.6	11.3	54.8
03	228 04.0	. . 42.8	90 11.5	15.1	6 35.3	11.3	54.8
04	243 04.2	43.7	104 45.6	15.1	6 24.0	11.4	54.8
05	258 04.4	44.7	119 19.7	15.2	6 12.6	11.3	54.8
06	273 04.5	S 5 45.6	133 53.9	15.2	S 6 01.3	11.4	54.8
07	288 04.7	46.6	148 28.1	15.2	5 49.9	11.4	54.7
S 08	303 04.9	47.5	163 02.3	15.3	5 38.5	11.4	54.7
A 09	318 05.1	. . 48.5	177 36.6	15.3	5 27.1	11.4	54.7
T 10	333 05.2	49.4	192 10.9	15.3	5 15.7	11.4	54.7
U 11	348 05.4	50.4	206 45.2	15.4	5 04.3	11.5	54.7
R 12	3 05.6	S 5 51.4	221 19.6	15.4	S 4 52.8	11.4	54.7
D 13	18 05.8	52.3	235 54.0	15.4	4 41.4	11.5	54.6
A 14	33 05.9	53.3	250 28.4	15.5	4 29.9	11.5	54.6
Y 15	48 06.1	. . 54.2	265 02.9	15.4	4 18.4	11.5	54.6
16	63 06.3	55.2	279 37.3	15.5	4 06.9	11.5	54.6
17	78 06.5	56.1	294 11.8	15.6	3 55.4	11.5	54.6
18	93 06.7	S 5 57.1	308 46.4	15.5	S 3 43.9	11.6	54.6
19	108 06.8	58.0	323 20.9	15.6	3 32.3	11.5	54.6
20	123 07.0	59.0	337 55.5	15.6	3 20.8	11.5	54.5
21	138 07.2	5 59.9	352 30.1	15.6	3 09.3	11.6	54.5
22	153 07.4	6 00.9	7 04.7	15.6	2 57.7	11.6	54.5
23	168 07.5	01.8	21 39.3	15.7	2 46.1	11.5	54.5
9 00	183 07.7	S 6 02.8	36 14.0	15.7	S 2 34.6	11.6	54.5
01	198 07.9	03.7	50 48.7	15.7	2 23.0	11.6	54.5
02	213 08.1	04.7	65 23.4	15.7	2 11.4	11.5	54.5
03	228 08.2	. . 05.6	79 58.1	15.7	1 59.9	11.6	54.5
04	243 08.4	06.6	94 32.8	15.8	1 48.3	11.6	54.4
05	258 08.6	07.5	109 07.6	15.8	1 36.7	11.6	54.4
06	273 08.7	S 6 08.5	123 42.4	15.7	S 1 25.1	11.6	54.4
07	288 08.9	09.4	138 17.1	15.8	1 13.5	11.6	54.4
08	303 09.1	10.4	152 51.9	15.8	1 01.9	11.5	54.4
S 09	318 09.3	. . 11.3	167 26.7	15.9	0 50.4	11.6	54.4
U 10	333 09.4	12.3	182 01.6	15.8	0 38.8	11.6	54.4
N 11	348 09.6	13.2	196 36.4	15.8	0 27.2	11.6	54.4
D 12	3 09.8	S 6 14.2	211 11.2	15.9	S 0 15.6	11.6	54.3
A 13	18 10.0	15.1	225 46.1	15.8	S 0 04.0	11.5	54.3
Y 14	33 10.1	16.1	240 20.9	15.9	N 0 07.5	11.6	54.3
15	48 10.3	. . 17.0	254 55.8	15.9	0 19.1	11.6	54.3
16	63 10.5	18.0	269 30.7	15.9	0 30.7	11.5	54.3
17	78 10.6	18.9	284 05.6	15.9	0 42.2	11.6	54.3
18	93 10.8	S 6 19.9	298 40.5	15.9	N 0 53.8	11.5	54.3
19	108 11.0	20.8	313 15.4	15.9	1 05.3	11.5	54.3
20	123 11.2	21.8	327 50.3	15.9	1 16.8	11.6	54.3
21	138 11.3	. . 22.7	342 25.2	15.9	1 28.4	11.5	54.2
22	153 11.5	23.7	357 00.1	15.9	1 39.9	11.5	54.2
23	168 11.7	24.6	11 35.0	15.9	N 1 51.4	11.5	54.2
	SD 16.0	d 1.0	SD 15.0		14.9		14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 7	Moonrise 8	Moonrise 9	Moonrise 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	04 22	05 41	06 49	16 33	16 14	15 57	15 40
N 70	04 29	05 41	06 42	16 20	16 08	15 57	15 47
68	04 36	05 41	06 36	16 10	16 04	15 58	15 52
66	04 41	05 40	06 32	16 01	16 00	15 58	15 57
64	04 45	05 40	06 28	15 54	15 56	15 59	16 01
62	04 48	05 40	06 24	15 47	15 53	15 59	16 04
60	04 51	05 40	06 21	15 42	15 51	15 59	16 07
N 58	04 54	05 39	06 19	15 37	15 49	15 59	16 10
56	04 56	05 39	06 16	15 33	15 47	16 00	16 13
54	04 58	05 39	06 14	15 29	15 45	16 00	16 15
52	04 59	05 38	06 12	15 25	15 43	16 00	16 17
50	05 00	05 38	06 10	15 22	15 42	16 00	16 19
45	05 03	05 37	06 06	15 15	15 38	16 00	16 23
N 40	05 04	05 36	06 03	15 09	15 35	16 01	16 26
35	05 05	05 34	06 00	15 04	15 33	16 01	16 29
30	05 05	05 33	05 57	14 59	15 31	16 01	16 31
20	05 05	05 30	05 53	14 51	15 27	16 02	16 36
N 10	05 03	05 27	05 48	14 45	15 24	16 02	16 40
0	04 59	05 24	05 44	14 38	15 21	16 02	16 44
S 10	04 55	05 19	05 40	14 32	15 18	16 03	16 48
20	04 48	05 14	05 36	14 25	15 14	16 03	16 52
30	04 38	05 06	05 30	14 17	15 11	16 04	16 56
35	04 32	05 02	05 27	14 12	15 09	16 04	16 59
40	04 24	04 57	05 24	14 07	15 06	16 04	17 02
45	04 14	04 50	05 20	14 01	15 03	16 05	17 06
S 50	04 02	04 42	05 15	13 53	15 00	16 05	17 10
52	03 56	04 38	05 13	13 50	14 58	16 05	17 12
54	03 49	04 34	05 10	13 46	14 57	16 06	17 14
56	03 42	04 29	05 07	13 42	14 55	16 06	17 17
58	03 33	04 24	05 04	13 37	14 52	16 06	17 19
S 60	03 23	04 17	05 01	13 32	14 50	16 07	17 22

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 7	Moonset 8	Moonset 9	Moonset 10
°	h m	h m	h m	h m	h m	h m	h m
N 72	16 44	17 52	19 11	25 28	01 28	03 15	05 00
N 70	16 51	17 52	19 03	25 39	01 39	03 18	04 56
68	16 57	17 53	18 57	00 10	01 47	03 21	04 52
66	17 02	17 53	18 52	00 23	01 54	03 23	04 49
64	17 06	17 54	18 48	00 34	02 00	03 24	04 47
62	17 10	17 54	18 45	00 43	02 05	03 26	04 45
60	17 13	17 54	18 42	00 51	02 10	03 27	04 43
N 58	17 16	17 55	18 40	00 58	02 14	03 28	04 41
56	17 18	17 55	18 38	01 04	02 17	03 29	04 40
54	17 20	17 56	18 36	01 09	02 20	03 30	04 39
52	17 22	17 56	18 35	01 14	02 23	03 31	04 38
50	17 24	17 57	18 34	01 18	02 25	03 31	04 36
45	17 28	17 58	18 32	01 28	02 31	03 33	04 34
N 40	17 32	17 59	18 30	01 35	02 36	03 34	04 32
35	17 35	18 00	18 30	01 42	02 39	03 35	04 31
30	17 38	18 02	18 29	01 48	02 43	03 36	04 29
20	17 42	18 05	18 30	01 58	02 49	03 38	04 27
N 10	17 47	18 08	18 32	02 07	02 54	03 40	04 24
0	17 51	18 12	18 36	02 15	02 59	03 41	04 22
S 10	17 55	18 16	18 41	02 23	03 04	03 42	04 20
20	18 00	18 22	18 48	02 32	03 09	03 44	04 18
30	18 05	18 29	18 58	02 42	03 14	03 45	04 15
35	18 08	18 34	19 04	02 47	03 18	03 46	04 14
40	18 12	18 40	19 12	02 54	03 21	03 47	04 12
45	18 16	18 46	19 22	03 01	03 26	03 48	04 10
S 50	18 21	18 55	19 35	03 10	03 31	03 50	04 08
52	18 24	18 58	19 41	03 14	03 33	03 50	04 07
54	18 26	19 03	19 47	03 18	03 36	03 51	04 06
56	18 29	19 08	19 55	03 23	03 38	03 52	04 05
58	18 32	19 13	20 04	03 29	03 41	03 53	04 03
S 60	18 36	19 20	20 15	03 35	03 45	03 54	04 02

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
7	11 56	12 05	11 48	20 48	08 27	10	82
8	12 13	12 22	11 48	21 31	09 10	11	89
9	12 30	12 39	11 47	22 12	09 52	12	94

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.9		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
10 00	18 15.3	169 12.9	S11 11.8	242 56.7	N18 15.9	342 21.7	N12 41.7	179 12.4	S 5 37.5
01	33 17.8	184 12.5	13.0	257 57.7	15.5	357 24.4	41.6	194 14.6	37.6
02	48 20.3	199 12.0	14.2	272 58.7	15.1	12 27.2	41.5	209 16.7	37.7
03	63 22.7	214 11.5 . .	15.3	287 59.7 . .	14.8	27 29.9 . .	41.4	224 18.9 . .	37.9
04	78 25.2	229 11.0	16.5	303 00.6	14.4	42 32.7	41.3	239 21.1	38.0
05	93 27.7	244 10.6	17.7	318 01.6	14.0	57 35.4	41.2	254 23.3	38.1
06	108 30.1	259 10.1	S11 18.8	333 02.6	N18 13.6	72 38.2	N12 41.1	269 25.5	S 5 38.2
07	123 32.6	274 09.6	20.0	348 03.6	13.3	87 40.9	41.0	284 27.6	38.3
08	138 35.0	289 09.1	21.1	3 04.6	12.9	102 43.7	40.9	299 29.8	38.4
M 09	153 37.5	304 08.6 . .	22.3	18 05.6 . .	12.5	117 46.4 . .	40.8	314 32.0 . .	38.5
O 10	168 40.0	319 08.2	23.5	33 06.6	12.1	132 49.2	40.7	329 34.2	38.7
N 11	183 42.4	334 07.7	24.6	48 07.6	11.8	147 51.9	40.6	344 36.4	38.8
D 12	198 44.9	349 07.2	S11 25.8	63 08.6	N18 11.4	162 54.7	N12 40.5	359 38.5	S 5 38.9
A 13	213 47.4	4 06.7	27.0	78 09.6	11.0	177 57.4	40.4	14 40.7	39.0
Y 14	228 49.8	19 06.2	28.1	93 10.6	10.6	193 00.2	40.3	29 42.9	39.1
15	243 52.3	34 05.8 . .	29.3	108 11.6 . .	10.3	208 02.9 . .	40.2	44 45.1 . .	39.2
16	258 54.8	49 05.3	30.4	123 12.6	09.9	223 05.7	40.1	59 47.3	39.3
17	273 57.2	64 04.8	31.6	138 13.6	09.5	238 08.4	40.0	74 49.4	39.5
18	288 59.7	79 04.3	S11 32.7	153 14.6	N18 09.1	253 11.2	N12 39.9	89 51.6	S 5 39.6
19	304 02.2	94 03.8	33.9	168 15.6	08.8	268 13.9	39.8	104 53.8	39.7
20	319 04.6	109 03.4	35.1	183 16.6	08.4	283 16.7	39.7	119 56.0	39.8
21	334 07.1	124 02.9 . .	36.2	198 17.6 . .	08.0	298 19.4 . .	39.6	134 58.2 . .	39.9
22	349 09.5	139 02.4	37.4	213 18.6	07.7	313 22.2	39.5	150 00.3	40.0
23	4 12.0	154 01.9	38.5	228 19.6	07.3	328 24.9	39.4	165 02.5	40.1
11 00	19 14.5	169 01.4	S11 39.7	243 20.6	N18 06.9	343 27.7	N12 39.3	180 04.7	S 5 40.3
01	34 16.9	184 00.9	40.8	258 21.6	06.5	358 30.4	39.2	195 06.9	40.4
02	49 19.4	199 00.5	42.0	273 22.6	06.2	13 33.2	39.1	210 09.1	40.5
03	64 21.9	214 00.0 . .	43.1	288 23.6 . .	05.8	28 35.9 . .	39.1	225 11.2 . .	40.6
04	79 24.3	228 59.5	44.3	303 24.6	05.4	43 38.7	39.0	240 13.4	40.7
05	94 26.8	243 59.0	45.5	318 25.6	05.0	58 41.5	38.9	255 15.6	40.8
06	109 29.3	258 58.5	S11 46.6	333 26.6	N18 04.6	73 44.2	N12 38.8	270 17.8	S 5 41.0
07	124 31.7	273 58.0	47.8	348 27.6	04.3	88 47.0	38.7	285 20.0	41.1
T 08	139 34.2	288 57.5	48.9	3 28.6	03.9	103 49.7	38.6	300 22.1	41.2
U 09	154 36.6	303 57.1 . .	50.1	18 29.6 . .	03.5	118 52.5 . .	38.5	315 24.3 . .	41.3
E 10	169 39.1	318 56.6	51.2	33 30.6	03.1	133 55.2	38.4	330 26.5	41.4
S 11	184 41.6	333 56.1	52.4	48 31.6	02.8	148 58.0	38.3	345 28.7	41.5
D 12	199 44.0	348 55.6	S11 53.5	63 32.6	N18 02.4	164 00.7	N12 38.2	0 30.9	S 5 41.6
A 13	214 46.5	3 55.1	54.7	78 33.6	02.0	179 03.5	38.1	15 33.0	41.8
Y 14	229 49.0	18 54.6	55.8	93 34.6	01.6	194 06.3	38.0	30 35.2	41.9
15	244 51.4	33 54.1 . .	57.0	108 35.6 . .	01.3	209 09.0 . .	37.9	45 37.4 . .	42.0
16	259 53.9	48 53.6	58.1	123 36.6	00.9	224 11.8	37.8	60 39.6	42.1
17	274 56.4	63 53.1	11 59.3	138 37.6	00.5	239 14.5	37.7	75 41.8	42.2
18	289 58.8	78 52.7	S12 00.4	153 38.6	N18 00.1	254 17.3	N12 37.6	90 43.9	S 5 42.3
19	305 01.3	93 52.2	01.5	168 39.6	17 59.8	269 20.0	37.5	105 46.1	42.4
20	320 03.8	108 51.7	02.7	183 40.6	59.4	284 22.8	37.4	120 48.3	42.6
21	335 06.2	123 51.2 . .	03.8	198 41.6 . .	59.0	299 25.5 . .	37.3	135 50.5 . .	42.7
22	350 08.7	138 50.7	05.0	213 42.6	58.6	314 28.3	37.2	150 52.7	42.8
23	5 11.1	153 50.2	06.1	228 43.6	58.2	329 31.1	37.1	165 54.8	42.9
12 00	20 13.6	168 49.7	S12 07.3	243 44.6	N17 57.9	344 33.8	N12 37.0	180 57.0	S 5 43.0
01	35 16.1	183 49.2	08.4	258 45.6	57.5	359 36.6	36.9	195 59.2	43.1
02	50 18.5	198 48.7	09.6	273 46.6	57.1	14 39.3	36.8	211 01.4	43.2
03	65 21.0	213 48.2 . .	10.7	288 47.6 . .	56.7	29 42.1 . .	36.7	226 03.6 . .	43.4
04	80 23.5	228 47.7	11.8	303 48.6	56.4	44 44.8	36.6	241 05.7	43.5
05	95 25.9	243 47.2	13.0	318 49.7	56.0	59 47.6	36.5	256 07.9	43.6
06	110 28.4	258 46.7	S12 14.1	333 50.7	N17 55.6	74 50.4	N12 36.4	271 10.1	S 5 43.7
W 07	125 30.9	273 46.2	15.3	348 51.7	55.2	89 53.1	36.3	286 12.3	43.8
E 08	140 33.3	288 45.7	16.4	3 52.7	54.8	104 55.9	36.2	301 14.5	43.9
D 09	155 35.8	303 45.2 . .	17.5	18 53.7 . .	54.5	119 58.6 . .	36.1	316 16.6 . .	44.0
N 10	170 38.2	318 44.7	18.7	33 54.7	54.1	135 01.4	36.0	331 18.8	44.2
E 11	185 40.7	333 44.2	19.8	48 55.7	53.7	150 04.2	35.9	346 21.0	44.3
S 12	200 43.2	348 43.7	S12 21.0	63 56.7	N17 53.3	165 06.9	N12 35.8	1 23.2	S 5 44.4
D 13	215 45.6	3 43.2	22.1	78 57.7	53.0	180 09.7	35.7	16 25.4	44.5
A 14	230 48.1	18 42.7	23.2	93 58.7	52.6	195 12.4	35.6	31 27.5	44.6
Y 15	245 50.6	33 42.2 . .	24.4	108 59.7 . .	52.2	210 15.2 . .	35.5	46 29.7 . .	44.7
16	260 53.0	48 41.7	25.5	124 00.8	51.8	225 18.0	35.4	61 31.9	44.8
17	275 55.5	63 41.2	26.6	139 01.8	51.4	240 20.7	35.3	76 34.1	45.0
18	290 58.0	78 40.7	S12 27.8	154 02.8	N17 51.1	255 23.5	N12 35.2	91 36.3	S 5 45.1
19	306 00.4	93 40.2	28.9	169 03.8	50.7	270 26.2	35.1	106 38.4	45.2
20	321 02.9	108 39.7	30.0	184 04.8	50.3	285 29.0	35.0	121 40.6	45.3
21	336 05.4	123 39.2 . .	31.2	199 05.8 . .	49.9	300 31.8 . .	34.9	136 42.8 . .	45.4
22	351 07.8	138 38.7	32.3	214 06.8	49.5	315 34.5	34.8	151 45.0	45.5
23	6 10.3	153 38.2	33.4	229 07.8	49.2	330 37.3	34.7	166 47.2	45.6
	h m								
Mer. Pass.	22 39.3	v −0.5	d 1.1	v 1.0	d 0.4	v 2.8	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.2
Achernar	335 27.0	S57 10.5
Acrux	173 11.4	S63 09.8
Adhara	255 13.4	S28 59.1
Aldebaran	290 50.5	N16 32.0
Alioth	166 22.2	N55 53.7
Alkaid	153 00.3	N49 15.3
Al Na'ir	27 44.9	S46 54.2
Alnilam	275 47.4	S 1 11.6
Alphard	217 57.4	S 8 42.5
Alphecca	126 12.3	N26 40.7
Alpheratz	357 44.4	N29 09.6
Altair	62 09.4	N 8 54.3
Ankaa	353 16.4	S42 14.4
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.4
Atria	107 31.2	S69 03.1
Avior	234 18.7	S59 32.6
Bellatrix	278 33.1	N 6 21.7
Betelgeuse	271 02.5	N 7 24.6
Canopus	263 56.6	S52 41.9
Capella	280 36.0	N46 00.4
Deneb	49 32.2	N45 19.8
Denebola	182 35.2	N14 30.4
Diphda	348 56.7	S17 55.1
Dubhe	193 53.6	N61 41.0
Elnath	278 14.0	N28 37.0
Eltanin	90 46.9	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.4
Gacrux	172 02.9	S57 10.7
Gienah	175 53.9	S17 36.4
Hadar	148 50.3	S60 25.8
Hamal	328 01.8	N23 31.2
Kaus Aust.	83 45.5	S34 22.7
Kochab	137 20.9	N74 06.5
Markab	13 39.3	N15 16.4
Menkar	314 16.0	N 4 08.3
Menkent	148 09.4	S36 25.7
Miaplacidus	221 40.5	S69 45.7
Mirfak	308 41.7	N49 54.1
Nunki	75 59.8	S26 16.8
Peacock	53 20.9	S56 41.9
Pollux	243 29.2	N27 59.7
Procyon	245 01.0	N 5 11.7
Rasalhague	96 07.7	N12 33.3
Regulus	207 45.0	N11 54.5
Rigel	281 13.0	S 8 11.2
Rigil Kent.	139 54.0	S60 53.0
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.3
Shaula	96 23.7	S37 06.7
Sirius	258 34.7	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.6	S43 28.6
Vega	80 39.9	N38 48.0
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	149 47.0	12 44
Mars	224 06.1	7 46
Jupiter	324 13.2	1 06
Saturn	160 50.2	11 58

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
10 00	183 11.8	S 6 25.6	26 09.9	15.9	N 2 02.9	11.5	54.2
01	198 12.0	26.5	40 44.8	15.9	2 14.4	11.4	54.2
02	213 12.2	27.5	55 19.7	15.9	2 25.8	11.5	54.2
03	228 12.3	28.4	69 54.6	15.9	2 37.3	11.5	54.2
04	243 12.5	29.4	84 29.5	16.0	2 48.8	11.4	54.2
05	258 12.7	30.3	99 04.5	15.9	3 00.2	11.4	54.2
06	273 12.9	S 6 31.3	113 39.4	15.9	N 3 11.6	11.4	54.2
07	288 13.0	32.2	128 14.3	15.9	3 23.0	11.4	54.2
08	303 13.2	33.2	142 49.2	15.8	3 34.4	11.4	54.2
M 09	318 13.4	34.1	157 24.0	15.9	3 45.8	11.3	54.1
O 10	333 13.5	35.1	171 58.9	15.9	3 57.1	11.3	54.1
N 11	348 13.7	36.0	186 33.8	15.9	4 08.4	11.4	54.1
D 12	3 13.9	S 6 36.9	201 08.7	15.9	N 4 19.8	11.3	54.1
A 13	18 14.0	37.9	215 43.6	15.8	4 31.1	11.2	54.1
Y 14	33 14.2	38.8	230 18.4	15.9	4 42.3	11.3	54.1
15	48 14.4	39.8	244 53.3	15.8	4 53.6	11.2	54.1
16	63 14.5	40.7	259 28.1	15.8	5 04.8	11.2	54.1
17	78 14.7	41.7	274 02.9	15.8	5 16.0	11.2	54.1
18	93 14.9	S 6 42.6	288 37.7	15.8	N 5 27.2	11.2	54.1
19	108 15.0	43.6	303 12.5	15.8	5 38.4	11.1	54.1
20	123 15.2	44.5	317 47.3	15.8	5 49.5	11.1	54.1
21	138 15.4	45.5	332 22.1	15.8	6 00.6	11.1	54.1
22	153 15.5	46.4	346 56.9	15.7	6 11.7	11.1	54.1
23	168 15.7	47.3	1 31.6	15.8	6 22.8	11.0	54.1
11 00	183 15.9	S 6 48.3	16 06.4	15.7	N 6 33.8	11.0	54.0
01	198 16.0	49.2	30 41.1	15.7	6 44.8	11.0	54.0
02	213 16.2	50.2	45 15.8	15.7	6 55.8	11.0	54.0
03	228 16.4	51.1	59 50.5	15.6	7 06.8	10.9	54.0
04	243 16.5	52.1	74 25.1	15.7	7 17.7	10.9	54.0
05	258 16.7	53.0	88 59.8	15.6	7 28.6	10.8	54.0
06	273 16.9	S 6 54.0	103 34.4	15.6	N 7 39.4	10.9	54.0
07	288 17.0	54.9	118 09.0	15.6	7 50.3	10.8	54.0
T 08	303 17.2	55.8	132 43.6	15.6	8 01.1	10.7	54.0
U 09	318 17.3	56.8	147 18.2	15.5	8 11.8	10.8	54.0
E 10	333 17.5	57.7	161 52.7	15.5	8 22.6	10.7	54.0
S 11	348 17.7	58.7	176 27.2	15.5	8 33.3	10.6	54.0
D 12	3 17.8	S 6 59.6	191 01.7	15.5	N 8 43.9	10.6	54.0
A 13	18 18.0	7 00.6	205 36.2	15.4	8 54.5	10.6	54.0
Y 14	33 18.2	01.5	220 10.6	15.5	9 05.1	10.6	54.0
15	48 18.3	02.4	234 45.1	15.4	9 15.7	10.5	54.0
16	63 18.5	03.4	249 19.5	15.3	9 26.2	10.5	54.0
17	78 18.6	04.3	263 53.8	15.4	9 36.7	10.4	54.0
18	93 18.8	S 7 05.3	278 28.2	15.3	N 9 47.1	10.4	54.0
19	108 19.0	06.2	293 02.5	15.3	9 57.5	10.4	54.0
20	123 19.1	07.2	307 36.8	15.3	10 07.9	10.3	54.0
21	138 19.3	08.1	322 11.1	15.2	10 18.2	10.2	54.0
22	153 19.5	09.0	336 45.3	15.2	10 28.4	10.3	54.0
23	168 19.6	10.0	351 19.5	15.2	10 38.7	10.2	54.0
12 00	183 19.8	S 7 10.9	5 53.7	15.1	N10 48.9	10.1	54.0
01	198 19.9	11.9	20 27.8	15.1	10 59.0	10.1	54.0
02	213 20.1	12.8	35 01.9	15.1	11 09.1	10.1	54.0
03	228 20.3	13.7	49 36.0	15.1	11 19.2	10.0	54.0
04	243 20.4	14.7	64 10.1	15.0	11 29.2	9.9	54.0
05	258 20.6	15.6	78 44.1	15.0	11 39.1	9.9	54.0
06	273 20.7	S 7 16.6	93 18.1	14.9	N11 49.0	9.9	54.0
W 07	288 20.9	17.5	107 52.0	15.0	11 58.9	9.8	54.0
E 08	303 21.0	18.4	122 26.0	14.8	12 08.7	9.8	54.0
D 09	318 21.2	19.4	136 59.8	14.9	12 18.5	9.7	54.0
N 10	333 21.4	20.3	151 33.7	14.8	12 28.2	9.7	54.0
E 11	348 21.5	21.3	166 07.5	14.8	12 37.9	9.6	54.0
S 12	3 21.7	S 7 22.2	180 41.3	14.7	N12 47.5	9.5	54.0
D 13	18 21.8	23.1	195 15.0	14.7	12 57.0	9.5	54.0
A 14	33 22.0	24.1	209 48.7	14.7	13 06.5	9.5	54.0
Y 15	48 22.2	25.0	224 22.4	14.6	13 16.0	9.4	54.0
16	63 22.3	25.9	238 56.0	14.6	13 25.4	9.3	54.0
17	78 22.5	26.9	253 29.6	14.6	13 34.7	9.3	54.0
18	93 22.6	S 7 27.8	268 03.2	14.5	N13 44.0	9.3	54.0
19	108 22.8	28.8	282 36.7	14.5	13 53.3	9.1	54.0
20	123 22.9	29.7	297 10.2	14.4	14 02.4	9.2	54.0
21	138 23.1	30.6	311 43.6	14.4	14 11.6	9.0	54.0
22	153 23.2	31.6	326 17.0	14.4	14 20.6	9.0	54.0
23	168 23.4	32.5	340 50.4	14.3	N14 29.6	9.0	54.0
	SD 16.0	d 0.9	SD 14.7		14.7		14.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 10	Moonrise 11	Moonrise 12	Moonrise 13
°	h m	h m	h m	h m	h m	h m	h m
N 72	04 36	05 54	07 03	15 40	15 22	14 58	14 19
N 70	04 42	05 52	06 54	15 47	15 35	15 22	15 04
68	04 47	05 51	06 47	15 52	15 47	15 41	15 34
66	04 50	05 50	06 42	15 57	15 56	15 56	15 57
64	04 54	05 49	06 37	16 01	16 04	16 08	16 15
62	04 56	05 48	06 32	16 04	16 11	16 19	16 29
60	04 58	05 47	06 28	16 07	16 17	16 28	16 42
N 58	05 00	05 46	06 25	16 10	16 22	16 36	16 53
56	05 02	05 45	06 22	16 13	16 27	16 43	17 02
54	05 03	05 44	06 19	16 15	16 31	16 49	17 10
52	05 04	05 43	06 17	16 17	16 35	16 55	17 18
50	05 05	05 42	06 15	16 19	16 38	17 00	17 25
45	05 06	05 40	06 10	16 23	16 46	17 11	17 39
N 40	05 07	05 39	06 06	16 26	16 52	17 20	17 51
35	05 07	05 37	06 02	16 29	16 58	17 28	18 02
30	05 07	05 35	05 59	16 31	17 02	17 35	18 11
20	05 06	05 31	05 53	16 36	17 11	17 47	18 26
N 10	05 03	05 27	05 48	16 40	17 18	17 58	18 40
0	04 59	05 23	05 44	16 44	17 25	18 08	18 53
S 10	04 53	05 17	05 39	16 48	17 33	18 19	19 06
20	04 45	05 11	05 33	16 52	17 40	18 30	19 20
30	04 34	05 03	05 27	16 56	17 49	18 42	19 36
35	04 27	04 58	05 23	16 59	17 54	18 49	19 45
40	04 19	04 52	05 19	17 02	18 00	18 58	19 56
45	04 08	04 44	05 14	17 06	18 07	19 08	20 09
S 50	03 55	04 35	05 09	17 10	18 15	19 20	20 24
52	03 48	04 31	05 06	17 12	18 19	19 25	20 31
54	03 41	04 26	05 03	17 14	18 23	19 31	20 39
56	03 33	04 21	05 00	17 17	18 27	19 38	20 48
58	03 23	04 15	04 56	17 19	18 32	19 46	20 59
S 60	03 12	04 08	04 52	17 22	18 38	19 55	21 10

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 10	Moonset 11	Moonset 12	Moonset 13
°	h m	h m	h m	h m	h m	h m	h m
N 72	16 29	17 37	18 55	05 00	06 45	08 37	10 48
N 70	16 37	17 39	18 49	04 56	06 33	08 15	10 04
68	16 45	17 41	18 45	04 52	06 24	07 58	09 35
66	16 51	17 42	18 41	04 49	06 16	07 44	09 14
64	16 56	17 43	18 38	04 47	06 09	07 33	08 57
62	17 00	17 45	18 36	04 45	06 04	07 23	08 43
60	17 04	17 46	18 34	04 43	05 59	07 15	08 31
N 58	17 07	17 47	18 32	04 41	05 54	07 08	08 21
56	17 10	17 48	18 31	04 40	05 51	07 01	08 12
54	17 13	17 49	18 29	04 39	05 47	06 56	08 04
52	17 16	17 50	18 28	04 38	05 44	06 51	07 57
50	17 18	17 50	18 28	04 36	05 41	06 46	07 51
45	17 23	17 52	18 26	04 34	05 35	06 36	07 37
N 40	17 27	17 54	18 26	04 32	05 30	06 28	07 26
35	17 31	17 56	18 26	04 31	05 26	06 21	07 16
30	17 34	17 58	18 26	04 29	05 22	06 15	07 08
20	17 40	18 02	18 28	04 27	05 15	06 04	06 54
N 10	17 45	18 06	18 31	04 24	05 09	05 55	06 41
0	17 50	18 11	18 35	04 22	05 04	05 46	06 30
S 10	17 55	18 16	18 41	04 20	04 58	05 37	06 18
20	18 01	18 23	18 49	04 18	04 52	05 28	06 06
30	18 07	18 31	19 00	04 15	04 46	05 18	05 52
35	18 11	18 37	19 07	04 14	04 42	05 12	05 43
40	18 15	18 43	19 16	04 12	04 38	05 05	05 34
45	18 20	18 50	19 26	04 10	04 33	04 57	05 23
S 50	18 26	19 00	19 40	04 08	04 27	04 47	05 10
52	18 29	19 04	19 47	04 07	04 24	04 43	05 04
54	18 32	19 09	19 54	04 06	04 21	04 38	04 58
56	18 35	19 14	20 03	04 05	04 18	04 33	04 50
58	18 39	19 21	20 13	04 03	04 14	04 27	04 42
S 60	18 43	19 28	20 25	04 02	04 10	04 20	04 32

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
10	12 47	12 55	11 47	22 54	10 33	13	98
11	13 03	13 11	11 47	23 36	11 15	14	100
12	13 19	13 26	11 47	24 19	11 57	15	100

UT	ARIES	VENUS −3.9		MARS +1.2		JUPITER −2.9		SATURN +0.7		STARS		
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Name	SHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
13 00	21 12.7	168 37.7	S12 34.6	244 08.8	N17 48.8	345 40.0	N12 34.6	181 49.3	S 5 45.8	Acamar	315 18.8	S40 15.2
01	36 15.2	183 37.2	35.7	259 09.9	48.4	0 42.8	34.5	196 51.5	45.9	Achernar	335 27.0	S57 10.5
02	51 17.7	198 36.7	36.8	274 10.9	48.0	15 45.6	34.4	211 53.7	46.0	Acrux	173 11.4	S63 09.8
03	66 20.1	213 36.2 . .	38.0	289 11.9 . .	47.6	30 48.3 . .	34.3	226 55.9 . .	46.1	Adhara	255 13.4	S28 59.1
04	81 22.6	228 35.7	39.1	304 12.9	47.3	45 51.1	34.1	241 58.1	46.2	Aldebaran	290 50.5	N16 32.0
05	96 25.1	243 35.2	40.2	319 13.9	46.9	60 53.8	34.0	257 00.2	46.3			
06	111 27.5	258 34.7	S12 41.4	334 14.9	N17 46.5	75 56.6	N12 33.9	272 02.4	S 5 46.4	Alioth	166 22.2	N55 53.7
07	126 30.0	273 34.2	42.5	349 15.9	46.1	90 59.4	33.8	287 04.6	46.6	Alkaid	153 00.3	N49 15.3
T 08	141 32.5	288 33.7	43.6	4 17.0	45.7	106 02.1	33.7	302 06.8	46.7	Al Na'ir	27 44.9	S46 54.2
H 09	156 34.9	303 33.2 . .	44.7	19 18.0 . .	45.3	121 04.9 . .	33.6	317 09.0 . .	46.8	Alnilam	275 47.4	S 1 11.6
U 10	171 37.4	318 32.7	45.9	34 19.0	45.0	136 07.7	33.5	332 11.1	46.9	Alphard	217 57.4	S 8 42.5
R 11	186 39.8	333 32.2	47.0	49 20.0	44.6	151 10.4	33.4	347 13.3	47.0			
S 12	201 42.3	348 31.6	S12 48.1	64 21.0	N17 44.2	166 13.2	N12 33.3	2 15.5	S 5 47.1	Alphecca	126 12.3	N26 40.7
D 13	216 44.8	3 31.1	49.2	79 22.0	43.8	181 15.9	33.2	17 17.7	47.2	Alpheratz	357 44.4	N29 09.6
A 14	231 47.2	18 30.6	50.4	94 23.1	43.4	196 18.7	33.1	32 19.9	47.4	Altair	62 09.4	N 8 54.3
Y 15	246 49.7	33 30.1 . .	51.5	109 24.1 . .	43.1	211 21.5 . .	33.0	47 22.0 . .	47.5	Ankaa	353 16.4	S42 14.4
16	261 52.2	48 29.6	52.6	124 25.1	42.7	226 24.2	32.9	62 24.2	47.6	Antares	112 28.0	S26 27.4
17	276 54.6	63 29.1	53.7	139 26.1	42.3	241 27.0	32.8	77 26.4	47.7			
18	291 57.1	78 28.6	S12 54.9	154 27.1	N17 41.9	256 29.8	N12 32.7	92 28.6	S 5 47.8	Arcturus	145 57.1	N19 07.4
19	306 59.6	93 28.1	56.0	169 28.1	41.5	271 32.5	32.6	107 30.8	47.9	Atria	107 31.2	S69 03.0
20	322 02.0	108 27.6	57.1	184 29.2	41.2	286 35.3	32.5	122 32.9	48.0	Avior	234 18.7	S59 32.6
21	337 04.5	123 27.1 . .	58.2	199 30.2 . .	40.8	301 38.1 . .	32.4	137 35.1 . .	48.2	Bellatrix	278 33.1	N 6 21.7
22	352 07.0	138 26.5	12 59.3	214 31.2	40.4	316 40.8	32.3	152 37.3	48.3	Betelgeuse	271 02.5	N 7 24.6
23	7 09.4	153 26.0	13 00.5	229 32.2	40.0	331 43.6	32.2	167 39.5	48.4			
14 00	22 11.9	168 25.5	S13 01.6	244 33.2	N17 39.6	346 46.4	N12 32.1	182 41.7	S 5 48.5	Canopus	263 56.5	S52 41.9
01	37 14.3	183 25.0	02.7	259 34.3	39.2	1 49.1	32.0	197 43.8	48.6	Capella	280 36.0	N46 00.4
02	52 16.8	198 24.5	03.8	274 35.3	38.9	16 51.9	31.9	212 46.0	48.7	Deneb	49 32.2	N45 19.8
03	67 19.3	213 24.0 . .	04.9	289 36.3 . .	38.5	31 54.6 . .	31.8	227 48.2 . .	48.8	Denebola	182 35.2	N14 30.4
04	82 21.7	228 23.5	06.1	304 37.3	38.1	46 57.4	31.7	242 50.4	49.0	Diphda	348 56.7	S17 55.1
05	97 24.2	243 22.9	07.2	319 38.3	37.7	62 00.2	31.6	257 52.6	49.1			
06	112 26.7	258 22.4	S13 08.3	334 39.4	N17 37.3	77 02.9	N12 31.5	272 54.7	S 5 49.2	Dubhe	193 53.6	N61 41.0
07	127 29.1	273 21.9	09.4	349 40.4	36.9	92 05.7	31.4	287 56.9	49.3	Elnath	278 13.9	N28 37.0
08	142 31.6	288 21.4	10.5	4 41.4	36.6	107 08.5	31.3	302 59.1	49.4	Eltanin	90 46.9	N51 29.6
F 09	157 34.1	303 20.9 . .	11.6	19 42.4 . .	36.2	122 11.2 . .	31.2	318 01.3 . .	49.5	Enif	33 48.1	N 9 56.0
R 10	172 36.5	318 20.3	12.7	34 43.4	35.8	137 14.0	31.1	333 03.5	49.6	Fomalhaut	15 25.0	S29 33.5
I 11	187 39.0	333 19.8	13.9	49 44.5	35.4	152 16.8	31.0	348 05.6	49.8			
D 12	202 41.5	348 19.3	S13 15.0	64 45.5	N17 35.0	167 19.5	N12 30.9	3 07.8	S 5 49.9	Gacrux	172 02.9	S57 10.7
A 13	217 43.9	3 18.8	16.1	79 46.5	34.6	182 22.3	30.8	18 10.0	50.0	Gienah	175 53.9	S17 36.4
Y 14	232 46.4	18 18.3	17.2	94 47.5	34.3	197 25.1	30.7	33 12.2	50.1	Hadar	148 50.3	S60 25.8
15	247 48.8	33 17.7 . .	18.3	109 48.6 . .	33.9	212 27.8 . .	30.6	48 14.4 . .	50.2	Hamal	328 01.8	N23 31.2
16	262 51.3	48 17.2	19.4	124 49.6	33.5	227 30.6	30.5	63 16.5	50.3	Kaus Aust.	83 45.5	S34 22.7
17	277 53.8	63 16.7	20.5	139 50.6	33.1	242 33.4	30.4	78 18.7	50.4			
18	292 56.2	78 16.2	S13 21.6	154 51.6	N17 32.7	257 36.1	N12 30.3	93 20.9	S 5 50.6	Kochab	137 20.9	N74 06.5
19	307 58.7	93 15.7	22.7	169 52.7	32.3	272 38.9	30.2	108 23.1	50.7	Markab	13 39.3	N15 16.4
20	323 01.2	108 15.1	23.9	184 53.7	32.0	287 41.7	30.1	123 25.3	50.8	Menkar	314 16.0	N 4 08.3
21	338 03.6	123 14.6 . .	25.0	199 54.7 . .	31.6	302 44.4 . .	30.0	138 27.4 . .	50.9	Menkent	148 09.4	S36 25.6
22	353 06.1	138 14.1	26.1	214 55.7	31.2	317 47.2	29.9	153 29.6	51.0	Miaplacidus	221 40.4	S69 45.7
23	8 08.6	153 13.6	27.2	229 56.8	30.8	332 50.0	29.8	168 31.8	51.1			
15 00	23 11.0	168 13.0	S13 28.3	244 57.8	N17 30.4	347 52.8	N12 29.6	183 34.0	S 5 51.2	Mirfak	308 41.7	N49 54.1
01	38 13.5	183 12.5	29.4	259 58.8	30.0	2 55.5	29.5	198 36.2	51.3	Nunki	75 59.8	S26 16.8
02	53 15.9	198 12.0	30.5	274 59.8	29.6	17 58.3	29.4	213 38.3	51.5	Peacock	53 20.9	S56 41.9
03	68 18.4	213 11.5 . .	31.6	290 00.9 . .	29.3	33 01.1 . .	29.3	228 40.5 . .	51.6	Pollux	243 29.2	N27 59.7
04	83 20.9	228 10.9	32.7	305 01.9	28.9	48 03.8	29.2	243 42.7	51.7	Procyon	245 01.0	N 5 11.7
05	98 23.3	243 10.4	33.8	320 02.9	28.5	63 06.6	29.1	258 44.9	51.8			
06	113 25.8	258 09.9	S13 34.9	335 04.0	N17 28.1	78 09.4	N12 29.0	273 47.1	S 5 51.9	Rasalhague	96 07.7	N12 33.3
07	128 28.3	273 09.4	36.0	350 05.0	27.7	93 12.1	28.9	288 49.2	52.0	Regulus	207 45.0	N11 54.5
S 08	143 30.7	288 08.8	37.1	5 06.0	27.3	108 14.9	28.8	303 51.4	52.1	Rigel	281 13.0	S 8 11.2
A 09	158 33.2	303 08.3 . .	38.2	20 07.0 . .	26.9	123 17.7 . .	28.7	318 53.6 . .	52.3	Rigil Kent.	139 54.0	S60 53.0
T 10	173 35.7	318 07.8	39.3	35 08.1	26.6	138 20.4	28.6	333 55.8	52.4	Sabik	102 14.1	S15 44.3
U 11	188 38.1	333 07.2	40.4	50 09.1	26.2	153 23.2	28.5	348 57.9	52.5			
R 12	203 40.6	348 06.7	S13 41.5	65 10.1	N17 25.8	168 26.0	N12 28.4	4 00.1	S 5 52.6	Schedar	349 41.4	N56 36.3
D 13	218 43.1	3 06.2	42.6	80 11.2	25.4	183 28.8	28.3	19 02.3	52.7	Shaula	96 23.7	S37 06.7
A 14	233 45.5	18 05.6	43.7	95 12.2	25.0	198 31.5	28.2	34 04.5	52.8	Sirius	258 34.7	S16 43.8
Y 15	248 48.0	33 05.1 . .	44.8	110 13.2 . .	24.6	213 34.3 . .	28.1	49 06.7 . .	52.9	Spica	158 32.8	S11 13.3
16	263 50.4	48 04.6	45.9	125 14.3	24.2	228 37.1	28.0	64 08.8	53.1	Suhail	222 53.5	S43 28.6
17	278 52.9	63 04.1	47.0	140 15.3	23.9	243 39.8	27.9	79 11.0	53.2			
18	293 55.4	78 03.5	S13 48.1	155 16.3	N17 23.5	258 42.6	N12 27.8	94 13.2	S 5 53.3	Vega	80 39.9	N38 48.0
19	308 57.8	93 03.0	49.2	170 17.4	23.1	273 45.4	27.7	109 15.4	53.4	Zuben'ubi	137 07.1	S16 05.4
20	324 00.3	108 02.5	50.3	185 18.4	22.7	288 48.1	27.6	124 17.6	53.5		SHA	Mer. Pass.
21	339 02.8	123 01.9 . .	51.4	200 19.4 . .	22.3	303 50.9 . .	27.5	139 19.7 . .	53.6		° ′	h m
22	354 05.2	138 01.4	52.5	215 20.5	21.9	318 53.7	27.4	154 21.9	53.7	Venus	146 13.6	12 47
23	9 07.7	153 00.8	53.6	230 21.5	21.5	333 56.5	27.3	169 24.1	53.9	Mars	222 21.4	7 41
	h m									Jupiter	324 34.5	0 53
Mer. Pass.	22 27.5	v −0.5	d 1.1	v 1.0	d 0.4	v 2.8	d 0.1	v 2.2	d 0.1	Saturn	160 29.8	11 48

UT	SUN			MOON					
	GHA		Dec	GHA	v	Dec	d	HP
d h	° ′		° ′	° ′	′	° ′	′	′
13 00	183 23.6	S	7 33.4	355 23.7	14.3	N14 38.6	8.9	54.0
01	198 23.7		34.4	9 57.0	14.2	14 47.5	8.8	54.0
02	213 23.9		35.3	24 30.2	14.2	14 56.3	8.7	54.0
03	228 24.0	. .	36.3	39 03.4	14.2	15 05.0	8.7	54.0
04	243 24.2		37.2	53 36.6	14.1	15 13.7	8.7	54.0
05	258 24.3		38.1	68 09.7	14.1	15 22.4	8.5	54.0
06	273 24.5	S	7 39.1	82 42.8	14.0	N15 30.9	8.5	54.0
07	288 24.6		40.0	97 15.8	14.0	15 39.4	8.5	54.0
08	303 24.8		40.9	111 48.8	13.9	15 47.9	8.3	54.0
09	318 24.9	. .	41.9	126 21.7	13.9	15 56.2	8.3	54.0
10	333 25.1		42.8	140 54.6	13.9	16 04.5	8.3	54.0
11	348 25.2		43.7	155 27.5	13.8	16 12.8	8.2	54.0
12	3 25.4	S	7 44.7	170 00.3	13.7	N16 21.0	8.1	54.0
13	18 25.6		45.6	184 33.0	13.7	16 29.1	8.0	54.0
14	33 25.7		46.5	199 05.7	13.7	16 37.1	7.9	54.0
15	48 25.9	. .	47.5	213 38.4	13.7	16 45.0	7.9	54.0
16	63 26.0		48.4	228 11.1	13.5	16 52.9	7.9	54.0
17	78 26.2		49.3	242 43.6	13.6	17 00.8	7.7	54.0
18	93 26.3	S	7 50.3	257 16.2	13.5	N17 08.5	7.7	54.0
19	108 26.5		51.2	271 48.7	13.4	17 16.2	7.6	54.0
20	123 26.6		52.1	286 21.1	13.4	17 23.8	7.5	54.0
21	138 26.8	. .	53.1	300 53.5	13.4	17 31.3	7.5	54.0
22	153 26.9		54.0	315 25.9	13.3	17 38.8	7.3	54.0
23	168 27.1		54.9	329 58.2	13.3	17 46.1	7.3	54.0
14 00	183 27.2	S	7 55.9	344 30.5	13.2	N17 53.4	7.3	54.1
01	198 27.4		56.8	359 02.7	13.2	18 00.7	7.1	54.1
02	213 27.5		57.7	13 34.9	13.1	18 07.8	7.1	54.1
03	228 27.7	. .	58.7	28 07.0	13.1	18 14.9	7.0	54.1
04	243 27.8		7 59.6	42 39.1	13.0	18 21.9	6.9	54.1
05	258 28.0		8 00.5	57 11.1	13.0	18 28.8	6.8	54.1
06	273 28.1	S	8 01.5	71 43.1	13.0	N18 35.6	6.7	54.1
07	288 28.3		02.4	86 15.1	12.9	18 42.3	6.7	54.1
08	303 28.4		03.3	100 47.0	12.8	18 49.0	6.6	54.1
09	318 28.5	. .	04.2	115 18.8	12.8	18 55.6	6.5	54.1
10	333 28.7		05.2	129 50.6	12.8	19 02.1	6.4	54.1
11	348 28.8		06.1	144 22.4	12.7	19 08.5	6.3	54.1
12	3 29.0	S	8 07.0	158 54.1	12.7	N19 14.8	6.3	54.1
13	18 29.1		08.0	173 25.8	12.6	19 21.1	6.1	54.1
14	33 29.3		08.9	187 57.4	12.6	19 27.2	6.1	54.1
15	48 29.4	. .	09.8	202 29.0	12.5	19 33.3	6.0	54.2
16	63 29.6		10.8	217 00.5	12.5	19 39.3	5.9	54.2
17	78 29.7		11.7	231 32.0	12.4	19 45.2	5.8	54.2
18	93 29.9	S	8 12.6	246 03.4	12.4	N19 51.0	5.8	54.2
19	108 30.0		13.5	260 34.8	12.4	19 56.8	5.6	54.2
20	123 30.2		14.5	275 06.2	12.3	20 02.4	5.6	54.2
21	138 30.3	. .	15.4	289 37.5	12.2	20 08.0	5.4	54.2
22	153 30.4		16.3	304 08.7	12.3	20 13.4	5.4	54.2
23	168 30.6		17.3	318 40.0	12.1	20 18.8	5.3	54.2
15 00	183 30.7	S	8 18.2	333 11.1	12.1	N20 24.1	5.1	54.2
01	198 30.9		19.1	347 42.2	12.1	20 29.2	5.1	54.2
02	213 31.0		20.0	2 13.3	12.1	20 34.3	5.0	54.3
03	228 31.2	. .	21.0	16 44.4	12.0	20 39.3	4.9	54.3
04	243 31.3		21.9	31 15.4	11.9	20 44.2	4.8	54.3
05	258 31.5		22.8	45 46.3	11.9	20 49.0	4.8	54.3
06	273 31.6	S	8 23.7	60 17.2	11.9	N20 53.8	4.6	54.3
07	288 31.7		24.7	74 48.1	11.8	20 58.4	4.5	54.3
08	303 31.9		25.6	89 18.9	11.8	21 02.9	4.4	54.3
09	318 32.0	. .	26.5	103 49.7	11.7	21 07.3	4.4	54.3
10	333 32.2		27.4	118 20.4	11.7	21 11.7	4.2	54.3
11	348 32.3		28.4	132 51.1	11.6	21 15.9	4.1	54.4
12	3 32.4	S	8 29.3	147 21.7	11.7	N21 20.0	4.1	54.4
13	18 32.6		30.2	161 52.4	11.5	21 24.1	3.9	54.4
14	33 32.7		31.1	176 22.9	11.6	21 28.0	3.8	54.4
15	48 32.9	. .	32.1	190 53.5	11.4	21 31.8	3.8	54.4
16	63 33.0		33.0	205 23.9	11.5	21 35.6	3.6	54.4
17	78 33.1		33.9	219 54.4	11.4	21 39.2	3.5	54.4
18	93 33.3	S	8 34.8	234 24.8	11.4	N21 42.7	3.5	54.4
19	108 33.4		35.8	248 55.2	11.3	21 46.2	3.3	54.5
20	123 33.6		36.7	263 25.5	11.3	21 49.5	3.2	54.5
21	138 33.7	. .	37.6	277 55.8	11.3	21 52.7	3.2	54.5
22	153 33.8		38.5	292 26.1	11.2	21 55.9	3.0	54.5
23	168 34.0		39.5	306 56.3	11.2	N21 58.9	2.9	54.5
	SD 16.1	d	0.9	SD	14.7	14.7		14.8

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		13	14	15	16
°	h m	h m	h m	h m	h m	h m	h m
N 72	04 49	06 07	07 17	14 19			
N 70	04 54	06 04	07 07	15 04	14 27		
68	04 57	06 02	06 58	15 34	15 26	15 11	
66	05 00	05 59	06 51	15 57	16 00	16 10	16 34
64	05 02	05 57	06 45	16 15	16 25	16 44	17 17
62	05 04	05 55	06 40	16 29	16 45	17 09	17 45
60	05 06	05 54	06 36	16 42	17 01	17 28	18 07
N 58	05 07	05 52	06 32	16 53	17 15	17 45	18 25
56	05 08	05 51	06 28	17 02	17 27	17 58	18 40
54	05 08	05 49	06 25	17 10	17 37	18 10	18 53
52	05 09	05 48	06 22	17 18	17 46	18 21	19 05
50	05 10	05 47	06 20	17 25	17 54	18 31	19 15
45	05 10	05 44	06 14	17 39	18 12	18 51	19 36
N 40	05 10	05 42	06 09	17 51	18 26	19 07	19 53
35	05 10	05 39	06 05	18 02	18 39	19 20	20 07
30	05 09	05 37	06 01	18 11	18 49	19 32	20 20
20	05 06	05 32	05 54	18 26	19 08	19 53	20 41
N 10	05 03	05 27	05 48	18 40	19 24	20 11	21 00
0	04 58	05 22	05 43	18 53	19 39	20 28	21 18
S 10	04 51	05 16	05 37	19 06	19 55	20 44	21 35
20	04 42	05 08	05 31	19 20	20 11	21 02	21 54
30	04 31	04 59	05 24	19 36	20 30	21 23	22 15
35	04 23	04 54	05 19	19 45	20 41	21 35	22 28
40	04 14	04 47	05 15	19 56	20 53	21 49	22 43
45	04 02	04 39	05 09	20 09	21 08	22 06	23 00
S 50	03 48	04 29	05 02	20 24	21 27	22 27	23 21
52	03 41	04 24	04 59	20 31	21 36	22 37	23 32
54	03 33	04 19	04 56	20 39	21 45	22 48	23 43
56	03 23	04 13	04 52	20 48	21 57	23 00	23 56
58	03 13	04 06	04 48	20 59	22 09	23 15	24 12
S 60	03 00	03 58	04 43	21 10	22 24	23 32	24 30

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	13	14	15	16
°	h m	h m	h m	h m	h m	h m	h m
N 72	16 13	17 23	18 40	10 48			
N 70	16 24	17 26	18 36	10 04	12 17		
68	16 32	17 29	18 33	09 35	11 19	13 13	
66	16 39	17 31	18 30	09 14	10 45	12 15	13 33
64	16 45	17 33	18 28	08 57	10 21	11 41	12 51
62	16 51	17 35	18 27	08 43	10 01	11 16	12 22
60	16 55	17 37	18 25	08 31	09 46	10 57	12 00
N 58	16 59	17 39	18 24	08 21	09 33	10 41	11 42
56	17 03	17 40	18 23	08 12	09 21	10 27	11 27
54	17 06	17 42	18 23	08 04	09 11	10 16	11 15
52	17 09	17 43	18 22	07 57	09 02	10 05	11 03
50	17 12	17 44	18 22	07 51	08 54	09 56	10 53
45	17 18	17 47	18 21	07 37	08 37	09 36	10 32
N 40	17 23	17 50	18 21	07 26	08 24	09 21	10 15
35	17 27	17 52	18 22	07 16	08 12	09 07	10 01
30	17 31	17 55	18 23	07 08	08 02	08 56	09 48
20	17 38	18 00	18 25	06 54	07 44	08 36	09 27
N 10	17 44	18 05	18 29	06 41	07 29	08 19	09 09
0	17 49	18 10	18 35	06 30	07 15	08 02	08 52
S 10	17 55	18 17	18 41	06 18	07 01	07 46	08 34
20	18 02	18 24	18 50	06 06	06 46	07 29	08 16
30	18 09	18 33	19 02	05 52	06 29	07 09	07 55
35	18 13	18 39	19 10	05 43	06 19	06 58	07 42
40	18 18	18 46	19 19	05 34	06 07	06 45	07 28
45	18 24	18 54	19 31	05 23	05 54	06 29	07 11
S 50	18 31	19 05	19 46	05 10	05 37	06 10	06 50
52	18 34	19 10	19 53	05 04	05 30	06 01	06 40
54	18 38	19 15	20 01	04 58	05 21	05 51	06 29
56	18 42	19 21	20 11	04 50	05 12	05 40	06 16
58	18 46	19 28	20 22	04 42	05 01	05 27	06 01
S 60	18 51	19 36	20 35	04 32	04 49	05 11	05 44

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
13	13 34	13 41	11 46	00 19	12 41	16	98
14	13 49	13 56	11 46	01 04	13 27	17	95
15	14 03	14 09	11 46	01 51	14 15	18	90

THURSDAY

FRIDAY

SATURDAY

UT	ARIES	VENUS −3.8		MARS +1.2		JUPITER −2.9		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
16 00	24 10.2	168 00.3	S13 54.7	245 22.5	N17 21.1	348 59.2	N12 27.2	184 26.3	S 5 54.0
01	39 12.6	182 59.8	55.7	260 23.6	20.8	4 02.0	27.1	199 28.5	54.1
02	54 15.1	197 59.2	56.8	275 24.6	20.4	19 04.8	27.0	214 30.6	54.2
03	69 17.6	212 58.7	57.9	290 25.6	20.0	34 07.5	26.8	229 32.8	54.3
04	84 20.0	227 58.2	13 59.0	305 26.7	19.6	49 10.3	26.7	244 35.0	54.4
05	99 22.5	242 57.6	14 00.1	320 27.7	19.2	64 13.1	26.6	259 37.2	54.5
06	114 24.9	257 57.1	S14 01.2	335 28.7	N17 18.8	79 15.9	N12 26.5	274 39.4	S 5 54.6
07	129 27.4	272 56.5	02.3	350 29.8	18.4	94 18.6	26.4	289 41.5	54.8
08	144 29.9	287 56.0	03.4	5 30.8	18.0	109 21.4	26.3	304 43.7	54.9
S 09	159 32.3	302 55.5	04.5	20 31.8	17.7	124 24.2	26.2	319 45.9	55.0
U 10	174 34.8	317 54.9	05.5	35 32.9	17.3	139 27.0	26.1	334 48.1	55.1
N 11	189 37.3	332 54.4	06.6	50 33.9	16.9	154 29.7	26.0	349 50.3	55.2
D 12	204 39.7	347 53.8	S14 07.7	65 34.9	N17 16.5	169 32.5	N12 25.9	4 52.4	S 5 55.3
A 13	219 42.2	2 53.3	08.8	80 36.0	16.1	184 35.3	25.8	19 54.6	55.4
Y 14	234 44.7	17 52.8	09.9	95 37.0	15.7	199 38.1	25.7	34 56.8	55.6
15	249 47.1	32 52.2	11.0	110 38.1	15.3	214 40.8	25.6	49 59.0	55.7
16	264 49.6	47 51.7	12.1	125 39.1	14.9	229 43.6	25.5	65 01.2	55.8
17	279 52.1	62 51.1	13.1	140 40.1	14.6	244 46.4	25.4	80 03.3	55.9
18	294 54.5	77 50.6	S14 14.2	155 41.2	N17 14.2	259 49.1	N12 25.3	95 05.5	S 5 56.0
19	309 57.0	92 50.0	15.3	170 42.2	13.8	274 51.9	25.2	110 07.7	56.1
20	324 59.4	107 49.5	16.4	185 43.3	13.4	289 54.7	25.1	125 09.9	56.2
21	340 01.9	122 49.0	17.5	200 44.3	13.0	304 57.5	25.0	140 12.1	56.4
22	355 04.4	137 48.4	18.5	215 45.3	12.6	320 00.2	24.9	155 14.2	56.5
23	10 06.8	152 47.9	19.6	230 46.4	12.2	335 03.0	24.8	170 16.4	56.6
17 00	25 09.3	167 47.3	S14 20.7	245 47.4	N17 11.8	350 05.8	N12 24.6	185 18.6	S 5 56.7
01	40 11.8	182 46.8	21.8	260 48.5	11.4	5 08.6	24.5	200 20.8	56.8
02	55 14.2	197 46.2	22.8	275 49.5	11.1	20 11.3	24.4	215 23.0	56.9
03	70 16.7	212 45.7	23.9	290 50.5	10.7	35 14.1	24.3	230 25.1	57.0
04	85 19.2	227 45.1	25.0	305 51.6	10.3	50 16.9	24.2	245 27.3	57.1
05	100 21.6	242 44.6	26.1	320 52.6	09.9	65 19.7	24.1	260 29.5	57.3
06	115 24.1	257 44.0	S14 27.1	335 53.7	N17 09.5	80 22.4	N12 24.0	275 31.7	S 5 57.4
07	130 26.5	272 43.5	28.2	350 54.7	09.1	95 25.2	23.9	290 33.8	57.5
08	145 29.0	287 42.9	29.3	5 55.8	08.7	110 28.0	23.8	305 36.0	57.6
M 09	160 31.5	302 42.4	30.4	20 56.8	08.3	125 30.8	23.7	320 38.2	57.7
O 10	175 33.9	317 41.8	31.4	35 57.8	07.9	140 33.5	23.6	335 40.4	57.8
N 11	190 36.4	332 41.3	32.5	50 58.9	07.5	155 36.3	23.5	350 42.6	57.9
D 12	205 38.9	347 40.7	S14 33.6	65 59.9	N17 07.2	170 39.1	N12 23.4	5 44.7	S 5 58.1
A 13	220 41.3	2 40.2	34.6	81 01.0	06.8	185 41.9	23.3	20 46.9	58.2
Y 14	235 43.8	17 39.6	35.7	96 02.0	06.4	200 44.7	23.2	35 49.1	58.3
15	250 46.3	32 39.1	36.8	111 03.1	06.0	215 47.4	23.1	50 51.3	58.4
16	265 48.7	47 38.5	37.9	126 04.1	05.6	230 50.2	23.0	65 53.5	58.5
17	280 51.2	62 37.9	38.9	141 05.2	05.2	245 53.0	22.9	80 55.6	58.6
18	295 53.7	77 37.4	S14 40.0	156 06.2	N17 04.8	260 55.8	N12 22.7	95 57.8	S 5 58.7
19	310 56.1	92 36.8	41.1	171 07.2	04.4	275 58.5	22.6	111 00.0	58.8
20	325 58.6	107 36.3	42.1	186 08.3	04.0	291 01.3	22.5	126 02.2	59.0
21	341 01.0	122 35.7	43.2	201 09.3	03.6	306 04.1	22.4	141 04.4	59.1
22	356 03.5	137 35.2	44.3	216 10.4	03.3	321 06.9	22.3	156 06.5	59.2
23	11 06.0	152 34.6	45.3	231 11.4	02.9	336 09.6	22.2	171 08.7	59.3
18 00	26 08.4	167 34.0	S14 46.4	246 12.5	N17 02.5	351 12.4	N12 22.1	186 10.9	S 5 59.4
01	41 10.9	182 33.5	47.4	261 13.5	02.1	6 15.2	22.0	201 13.1	59.5
02	56 13.4	197 32.9	48.5	276 14.6	01.7	21 18.0	21.9	216 15.3	59.6
03	71 15.8	212 32.4	49.6	291 15.6	01.3	36 20.8	21.8	231 17.4	59.8
04	86 18.3	227 31.8	50.6	306 16.7	00.9	51 23.5	21.7	246 19.6	5 59.9
05	101 20.8	242 31.2	51.7	321 17.7	00.5	66 26.3	21.6	261 21.8	6 00.0
06	116 23.2	257 30.7	S14 52.7	336 18.8	N17 00.1	81 29.1	N12 21.5	276 24.0	S 6 00.1
07	131 25.7	272 30.1	53.8	351 19.8	16 59.7	96 31.9	21.4	291 26.2	00.2
08	146 28.2	287 29.6	54.9	6 20.9	59.3	111 34.6	21.3	306 28.3	00.3
T 09	161 30.6	302 29.0	55.9	21 21.9	58.9	126 37.4	21.2	321 30.5	00.4
U 10	176 33.1	317 28.4	57.0	36 23.0	58.6	141 40.2	21.0	336 32.7	00.5
E 11	191 35.5	332 27.9	58.0	51 24.0	58.2	156 43.0	20.9	351 34.9	00.7
S 12	206 38.0	347 27.3	S14 59.1	66 25.1	N16 57.8	171 45.8	N12 20.8	6 37.1	S 6 00.8
D 13	221 40.5	2 26.7	15 00.1	81 26.1	57.4	186 48.5	20.7	21 39.2	00.9
A 14	236 42.9	17 26.2	01.2	96 27.2	57.0	201 51.3	20.6	36 41.4	01.0
Y 15	251 45.4	32 25.6	02.3	111 28.2	56.6	216 54.1	20.5	51 43.6	01.1
16	266 47.9	47 25.0	03.3	126 29.3	56.2	231 56.9	20.4	66 45.8	01.2
17	281 50.3	62 24.5	04.4	141 30.3	55.8	246 59.7	20.3	81 48.0	01.3
18	296 52.8	77 23.9	S15 05.4	156 31.4	N16 55.4	262 02.4	N12 20.2	96 50.1	S 6 01.5
19	311 55.3	92 23.3	06.5	171 32.4	55.0	277 05.2	20.1	111 52.3	01.6
20	326 57.7	107 22.8	07.5	186 33.5	54.6	292 08.0	20.0	126 54.5	01.7
21	342 00.2	122 22.2	08.6	201 34.6	54.2	307 10.8	19.9	141 56.7	01.8
22	357 02.7	137 21.6	09.6	216 35.6	53.8	322 13.6	19.8	156 58.9	01.9
23	12 05.1	152 21.1	10.7	231 36.7	53.5	337 16.3	19.7	172 01.0	02.0
	h m								
Mer. Pass.	22 15.7	*v* −0.6	*d* 1.1	*v* 1.0	*d* 0.4	*v* 2.8	*d* 0.1	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.3
Achernar	335 27.0	S57 10.5
Acrux	173 11.4	S63 09.8
Adhara	255 13.4	S28 59.1
Aldebaran	290 50.5	N16 32.0
Alioth	166 22.2	N55 53.7
Alkaid	153 00.3	N49 15.3
Al Na'ir	27 44.9	S46 54.2
Alnilam	275 47.4	S 1 11.6
Alphard	217 57.4	S 8 42.5
Alphecca	126 12.3	N26 40.7
Alpheratz	357 44.4	N29 09.6
Altair	62 09.4	N 8 54.3
Ankaa	353 16.4	S42 14.4
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.3
Atria	107 31.3	S69 03.0
Avior	234 18.7	S59 32.6
Bellatrix	278 33.1	N 6 21.7
Betelgeuse	271 02.4	N 7 24.6
Canopus	263 56.5	S52 41.9
Capella	280 35.9	N46 00.4
Deneb	49 32.2	N45 19.8
Denebola	182 35.1	N14 30.3
Diphda	348 56.7	S17 55.1
Dubhe	193 53.6	N61 41.0
Elnath	278 13.9	N28 37.0
Eltanin	90 46.9	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.5
Gacrux	172 02.9	S57 10.7
Gienah	175 53.8	S17 36.4
Hadar	148 50.3	S60 25.8
Hamal	328 01.8	N23 31.2
Kaus Aust.	83 45.5	S34 22.7
Kochab	137 21.0	N74 06.5
Markab	13 39.3	N15 16.4
Menkar	314 16.0	N 4 08.3
Menkent	148 09.4	S36 25.6
Miaplacidus	221 40.4	S69 45.7
Mirfak	308 41.6	N49 54.2
Nunki	75 59.9	S26 16.8
Peacock	53 21.0	S56 41.9
Pollux	243 29.2	N27 59.7
Procyon	245 01.0	N 5 11.7
Rasalhague	96 07.7	N12 33.3
Regulus	207 45.0	N11 54.5
Rigel	281 13.0	S 8 11.2
Rigil Kent.	139 54.0	S60 53.0
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.3
Shaula	96 23.7	S37 06.7
Sirius	258 34.7	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.5	S43 28.6
Vega	80 39.9	N38 48.0
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	142 38.0	12 49
Mars	220 38.1	7 36
Jupiter	324 56.5	0 39
Saturn	160 09.3	11 37

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
16 00	183 34.1	S 8 40.4	321 26.5	11.1	N22 01.8	2.8	54.5
01	198 34.3	41.3	335 56.6	11.1	22 04.6	2.7	54.5
02	213 34.4	42.2	350 26.7	11.1	22 07.3	2.6	54.6
03	228 34.5	. . 43.1	4 56.8	11.0	22 09.9	2.5	54.6
04	243 34.7	44.1	19 26.8	11.0	22 12.4	2.4	54.6
05	258 34.8	45.0	33 56.8	11.0	22 14.8	2.3	54.6
06	273 34.9	S 8 45.9	48 26.8	11.0	N22 17.1	2.2	54.6
07	288 35.1	46.8	62 56.8	10.9	22 19.3	2.0	54.6
08	303 35.2	47.8	77 26.7	10.8	22 21.3	2.0	54.7
S 09	318 35.3	. . 48.7	91 56.5	10.9	22 23.3	1.8	54.7
U 10	333 35.5	49.6	106 26.4	10.8	22 25.1	1.8	54.7
N 11	348 35.6	50.5	120 56.2	10.8	22 26.9	1.6	54.7
D 12	3 35.8	S 8 51.4	135 26.0	10.7	N22 28.5	1.6	54.7
A 13	18 35.9	52.4	149 55.7	10.8	22 30.1	1.4	54.7
Y 14	33 36.0	53.3	164 25.5	10.7	22 31.5	1.3	54.8
15	48 36.2	. . 54.2	178 55.2	10.6	22 32.8	1.2	54.8
16	63 36.3	55.1	193 24.8	10.7	22 34.0	1.1	54.8
17	78 36.4	56.0	207 54.5	10.6	22 35.1	0.9	54.8
18	93 36.6	S 8 57.0	222 24.1	10.6	N22 36.0	0.9	54.8
19	108 36.7	57.9	236 53.7	10.5	22 36.9	0.8	54.8
20	123 36.8	58.8	251 23.2	10.5	22 37.7	0.6	54.9
21	138 37.0	8 59.7	265 52.7	10.6	22 38.3	0.5	54.9
22	153 37.1	9 00.6	280 22.3	10.4	22 38.8	0.4	54.9
23	168 37.2	01.5	294 51.7	10.5	22 39.2	0.3	54.9
17 00	183 37.4	S 9 02.5	309 21.2	10.4	N22 39.5	0.2	54.9
01	198 37.5	03.4	323 50.6	10.5	22 39.7	0.1	55.0
02	213 37.6	04.3	338 20.1	10.3	22 39.8	0.0	55.0
03	228 37.7	. . 05.2	352 49.4	10.4	22 39.8	0.2	55.0
04	243 37.9	06.1	7 18.8	10.4	22 39.6	0.2	55.0
05	258 38.0	07.0	21 48.2	10.3	22 39.4	0.4	55.0
06	273 38.1	S 9 08.0	36 17.5	10.3	N22 39.0	0.5	55.1
07	288 38.3	08.9	50 46.8	10.3	22 38.5	0.6	55.1
08	303 38.4	09.8	65 16.1	10.3	22 37.9	0.7	55.1
M 09	318 38.5	. . 10.7	79 45.4	10.3	22 37.2	0.9	55.1
O 10	333 38.7	11.6	94 14.7	10.2	22 36.3	0.9	55.1
N 11	348 38.8	12.5	108 43.9	10.2	22 35.4	1.1	55.2
D 12	3 38.9	S 9 13.4	123 13.1	10.2	N22 34.3	1.2	55.2
A 13	18 39.0	14.4	137 42.3	10.2	22 33.1	1.2	55.2
Y 14	33 39.2	15.3	152 11.5	10.2	22 31.9	1.5	55.2
15	48 39.3	. . 16.2	166 40.7	10.2	22 30.4	1.5	55.3
16	63 39.4	17.1	181 09.9	10.2	22 28.9	1.6	55.3
17	78 39.6	18.0	195 39.1	10.1	22 27.3	1.8	55.3
18	93 39.7	S 9 18.9	210 08.2	10.1	N22 25.5	1.8	55.3
19	108 39.8	19.8	224 37.3	10.2	22 23.7	2.0	55.4
20	123 39.9	20.8	239 06.5	10.1	22 21.7	2.1	55.4
21	138 40.1	. . 21.7	253 35.6	10.1	22 19.6	2.2	55.4
22	153 40.2	22.6	268 04.7	10.1	22 17.4	2.4	55.4
23	168 40.3	23.5	282 33.8	10.1	22 15.0	2.4	55.5
18 00	183 40.4	S 9 24.4	297 02.9	10.1	N22 12.6	2.6	55.5
01	198 40.6	25.3	311 32.0	10.0	22 10.0	2.7	55.5
02	213 40.7	26.2	326 01.0	10.1	22 07.3	2.8	55.5
03	228 40.8	. . 27.1	340 30.1	10.1	22 04.5	2.9	55.6
04	243 40.9	28.1	354 59.2	10.0	22 01.6	3.0	55.6
05	258 41.1	29.0	9 28.2	10.1	21 58.6	3.1	55.6
06	273 41.2	S 9 29.9	23 57.3	10.0	N21 55.5	3.3	55.6
07	288 41.3	30.8	38 26.3	10.0	21 52.2	3.4	55.7
T 08	303 41.4	31.7	52 55.3	10.1	21 48.8	3.5	55.7
U 09	318 41.6	. . 32.6	67 24.4	10.0	21 45.3	3.6	55.7
E 10	333 41.7	33.5	81 53.4	10.0	21 41.7	3.7	55.7
S 11	348 41.8	34.4	96 22.4	10.1	21 38.0	3.8	55.8
D 12	3 41.9	S 9 35.3	110 51.5	10.0	N21 34.2	4.0	55.8
A 13	18 42.1	36.2	125 20.5	10.0	21 30.2	4.0	55.8
Y 14	33 42.2	37.2	139 49.5	10.1	21 26.2	4.2	55.8
15	48 42.3	. . 38.1	154 18.6	10.0	21 22.0	4.3	55.9
16	63 42.4	39.0	168 47.6	10.0	21 17.7	4.4	55.9
17	78 42.5	39.9	183 16.6	10.1	21 13.3	4.5	55.9
18	93 42.7	S 9 40.8	197 45.7	10.0	N21 08.8	4.6	56.0
19	108 42.8	41.7	212 14.7	10.0	21 04.2	4.8	56.0
20	123 42.9	42.6	226 43.7	10.1	20 59.4	4.9	56.0
21	138 43.0	. . 43.5	241 12.8	10.0	20 54.5	4.9	56.0
22	153 43.1	44.4	255 41.8	10.0	20 49.6	5.1	56.1
23	168 43.3	45.3	270 10.8	10.1	N20 44.5	5.2	56.1
	SD 16.1	d 0.9	SD	14.9	15.0		15.2

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 16	Moonrise 17	Moonrise 18	Moonrise 19
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 02	06 21	07 32				
N 70	05 05	06 16	07 20				19 13
68	05 08	06 12	07 10			18 00	20 01
66	05 09	06 09	07 01	16 34	17 29	18 53	20 31
64	05 11	06 06	06 54	17 17	18 11	19 25	20 54
62	05 12	06 03	06 48	17 45	18 39	19 49	21 12
60	05 13	06 01	06 43	18 07	19 01	20 08	21 26
N 58	05 13	05 59	06 39	18 25	19 18	20 24	21 39
56	05 14	05 57	06 34	18 40	19 33	20 37	21 50
54	05 14	05 55	06 31	18 53	19 46	20 49	21 59
52	05 14	05 53	06 27	19 05	19 57	20 59	22 08
50	05 14	05 52	06 24	19 15	20 07	21 08	22 15
45	05 14	05 48	06 18	19 36	20 28	21 27	22 32
N 40	05 13	05 45	06 12	19 53	20 45	21 43	22 45
35	05 12	05 42	06 07	20 07	20 59	21 56	22 56
30	05 11	05 39	06 03	20 20	21 12	22 07	23 06
20	05 07	05 33	05 55	20 41	21 33	22 27	23 23
N 10	05 03	05 27	05 49	21 00	21 51	22 44	23 37
0	04 57	05 21	05 42	21 18	22 08	23 00	23 51
S 10	04 49	05 14	05 36	21 35	22 26	23 16	24 05
20	04 40	05 06	05 28	21 54	22 44	23 33	24 19
30	04 27	04 56	05 20	22 15	23 05	23 52	24 36
35	04 19	04 50	05 15	22 28	23 17	24 03	00 03
40	04 09	04 42	05 10	22 43	23 32	24 16	00 16
45	03 56	04 33	05 04	23 00	23 49	24 32	00 32
S 50	03 41	04 22	04 56	23 21	24 09	00 09	00 50
52	03 33	04 17	04 52	23 32	24 19	00 19	00 59
54	03 24	04 11	04 49	23 43	24 30	00 30	01 09
56	03 14	04 04	04 44	23 56	24 43	00 43	01 20
58	03 02	03 57	04 39	24 12	00 12	00 58	01 33
S 60	02 48	03 48	04 34	24 30	00 30	01 15	01 48

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 16	Moonset 17	Moonset 18	Moonset 19
°	h m	h m	h m	h m	h m	h m	h m
N 72	15 57	17 08	18 26				
N 70	16 10	17 13	18 23				16 14
68	16 20	17 17	18 21			15 39	15 26
66	16 28	17 21	18 20	13 33	14 24	14 46	14 55
64	16 35	17 24	18 19	12 51	13 42	14 14	14 32
62	16 41	17 26	18 18	12 22	13 13	13 49	14 13
60	16 46	17 29	18 17	12 00	12 52	13 30	13 58
N 58	16 51	17 31	18 16	11 42	12 34	13 14	13 45
56	16 55	17 33	18 16	11 27	12 19	13 01	13 33
54	16 59	17 35	18 16	11 15	12 06	12 49	13 23
52	17 03	17 37	18 16	11 03	11 55	12 38	13 14
50	17 06	17 38	18 16	10 53	11 45	12 29	13 06
45	17 12	17 42	18 16	10 32	11 23	12 09	12 49
N 40	17 18	17 46	18 17	10 15	11 06	11 53	12 35
35	17 23	17 49	18 18	10 01	10 52	11 40	12 23
30	17 28	17 52	18 20	09 48	10 39	11 28	12 13
20	17 35	17 58	18 23	09 27	10 18	11 07	11 55
N 10	17 42	18 03	18 28	09 09	09 59	10 50	11 39
0	17 49	18 10	18 34	08 52	09 42	10 33	11 24
S 10	17 55	18 17	18 42	08 34	09 25	10 16	11 09
20	18 03	18 25	18 51	08 16	09 06	09 59	10 53
30	18 11	18 36	19 04	07 55	08 44	09 38	10 35
35	18 16	18 42	19 13	07 42	08 32	09 26	10 24
40	18 21	18 49	19 23	07 28	08 17	09 12	10 12
45	18 28	18 59	19 36	07 11	08 00	08 55	09 57
S 50	18 36	19 10	19 52	06 50	07 38	08 35	09 39
52	18 40	19 15	20 00	06 40	07 28	08 25	09 31
54	18 44	19 21	20 09	06 29	07 16	08 14	09 21
56	18 48	19 28	20 19	06 16	07 03	08 02	09 10
58	18 53	19 36	20 31	06 01	06 48	07 47	08 58
S 60	18 59	19 44	20 45	05 44	06 29	07 30	08 44

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
16	14 16	14 23	11 46	02 40	15 04	19	83
17	14 29	14 35	11 45	03 30	15 55	20	76
18	14 42	14 47	11 45	04 21	16 46	21	67

UT	ARIES	VENUS −3.8		MARS +1.2		JUPITER −2.9		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
19 00	27 07.6	167 20.5	S15 11.7	246 37.7	N16 53.1	352 19.1	N12 19.6	187 03.2	S 6 02.1
01	42 10.0	182 19.9	12.8	261 38.8	52.7	7 21.9	19.5	202 05.4	02.2
02	57 12.5	197 19.3	13.8	276 39.8	52.3	22 24.7	19.3	217 07.6	02.4
03	72 15.0	212 18.8	14.8	291 40.9	51.9	37 27.5	19.2	232 09.7	02.5
04	87 17.4	227 18.2	15.9	306 41.9	51.5	52 30.2	19.1	247 11.9	02.6
05	102 19.9	242 17.6	16.9	321 43.0	51.1	67 33.0	19.0	262 14.1	02.7
06	117 22.4	257 17.1	S15 18.0	336 44.1	N16 50.7	82 35.8	N12 18.9	277 16.3	S 6 02.8
W 07	132 24.8	272 16.5	19.0	351 45.1	50.3	97 38.6	18.8	292 18.5	02.9
E 08	147 27.3	287 15.9	20.1	6 46.2	49.9	112 41.4	18.7	307 20.6	03.0
D 09	162 29.8	302 15.3	21.1	21 47.2	49.5	127 44.1	18.6	322 22.8	03.1
N 10	177 32.2	317 14.8	22.1	36 48.3	49.1	142 46.9	18.5	337 25.0	03.3
E 11	192 34.7	332 14.2	23.2	51 49.3	48.7	157 49.7	18.4	352 27.2	03.4
S 12	207 37.1	347 13.6	S15 24.2	66 50.4	N16 48.3	172 52.5	N12 18.3	7 29.4	S 6 03.5
D 13	222 39.6	2 13.0	25.3	81 51.5	47.9	187 55.3	18.2	22 31.5	03.6
A 14	237 42.1	17 12.5	26.3	96 52.5	47.6	202 58.1	18.1	37 33.7	03.7
Y 15	252 44.5	32 11.9	27.3	111 53.6	47.2	218 00.8	18.0	52 35.9	03.8
16	267 47.0	47 11.3	28.4	126 54.6	46.8	233 03.6	17.8	67 38.1	03.9
17	282 49.5	62 10.7	29.4	141 55.7	46.4	248 06.4	17.7	82 40.3	04.0
18	297 51.9	77 10.1	S15 30.5	156 56.8	N16 46.0	263 09.2	N12 17.6	97 42.4	S 6 04.2
19	312 54.4	92 09.6	31.5	171 57.8	45.6	278 12.0	17.5	112 44.6	04.3
20	327 56.9	107 09.0	32.5	186 58.9	45.2	293 14.7	17.4	127 46.8	04.4
21	342 59.3	122 08.4	33.6	201 59.9	44.8	308 17.5	17.3	142 49.0	04.5
22	358 01.8	137 07.8	34.6	217 01.0	44.4	323 20.3	17.2	157 51.2	04.6
23	13 04.3	152 07.2	35.6	232 02.1	44.0	338 23.1	17.1	172 53.3	04.7
20 00	28 06.7	167 06.7	S15 36.7	247 03.1	N16 43.6	353 25.9	N12 17.0	187 55.5	S 6 04.8
01	43 09.2	182 06.1	37.7	262 04.2	43.2	8 28.7	16.9	202 57.7	05.0
02	58 11.6	197 05.5	38.7	277 05.3	42.8	23 31.4	16.8	217 59.9	05.1
03	73 14.1	212 04.9	39.7	292 06.3	42.4	38 34.2	16.7	233 02.1	05.2
04	88 16.6	227 04.3	40.8	307 07.4	42.0	53 37.0	16.6	248 04.2	05.3
05	103 19.0	242 03.7	41.8	322 08.4	41.6	68 39.8	16.4	263 06.4	05.4
06	118 21.5	257 03.1	S15 42.8	337 09.5	N16 41.2	83 42.6	N12 16.3	278 08.6	S 6 05.5
07	133 24.0	272 02.6	43.9	352 10.6	40.8	98 45.4	16.2	293 10.8	05.6
T 08	148 26.4	287 02.0	44.9	7 11.6	40.5	113 48.1	16.1	308 13.0	05.7
H 09	163 28.9	302 01.4	45.9	22 12.7	40.1	128 50.9	16.0	323 15.1	05.9
U 10	178 31.4	317 00.8	46.9	37 13.8	39.7	143 53.7	15.9	338 17.3	06.0
R 11	193 33.8	332 00.2	48.0	52 14.8	39.3	158 56.5	15.8	353 19.5	06.1
S 12	208 36.3	346 59.6	S15 49.0	67 15.9	N16 38.9	173 59.3	N12 15.7	8 21.7	S 6 06.2
D 13	223 38.8	1 59.0	50.0	82 17.0	38.5	189 02.1	15.6	23 23.9	06.3
A 14	238 41.2	16 58.4	51.0	97 18.0	38.1	204 04.8	15.5	38 26.0	06.4
Y 15	253 43.7	31 57.9	52.1	112 19.1	37.7	219 07.6	15.4	53 28.2	06.5
16	268 46.1	46 57.3	53.1	127 20.2	37.3	234 10.4	15.3	68 30.4	06.6
17	283 48.6	61 56.7	54.1	142 21.2	36.9	249 13.2	15.2	83 32.6	06.8
18	298 51.1	76 56.1	S15 55.1	157 22.3	N16 36.5	264 16.0	N12 15.0	98 34.8	S 6 06.9
19	313 53.5	91 55.5	56.1	172 23.4	36.1	279 18.8	14.9	113 36.9	07.0
20	328 56.0	106 54.9	57.1	187 24.4	35.7	294 21.5	14.8	128 39.1	07.1
21	343 58.5	121 54.3	58.2	202 25.5	35.3	309 24.3	14.7	143 41.3	07.2
22	359 00.9	136 53.7	15 59.2	217 26.6	34.9	324 27.1	14.6	158 43.5	07.3
23	14 03.4	151 53.1	16 00.2	232 27.6	34.5	339 29.9	14.5	173 45.7	07.4
21 00	29 05.9	166 52.5	S16 01.2	247 28.7	N16 34.1	354 32.7	N12 14.4	188 47.8	S 6 07.5
01	44 08.3	181 51.9	02.2	262 29.8	33.7	9 35.5	14.3	203 50.0	07.7
02	59 10.8	196 51.3	03.2	277 30.9	33.3	24 38.3	14.2	218 52.2	07.8
03	74 13.2	211 50.7	04.3	292 31.9	32.9	39 41.0	14.1	233 54.4	07.9
04	89 15.7	226 50.1	05.3	307 33.0	32.5	54 43.8	14.0	248 56.6	08.0
05	104 18.2	241 49.5	06.3	322 34.1	32.1	69 46.6	13.9	263 58.7	08.1
06	119 20.6	256 48.9	S16 07.3	337 35.1	N16 31.7	84 49.4	N12 13.8	279 00.9	S 6 08.2
07	134 23.1	271 48.3	08.3	352 36.2	31.3	99 52.2	13.6	294 03.1	08.3
08	149 25.6	286 47.7	09.3	7 37.3	30.9	114 55.0	13.5	309 05.3	08.4
F 09	164 28.0	301 47.1	10.3	22 38.4	30.6	129 57.7	13.4	324 07.5	08.5
R 10	179 30.5	316 46.5	11.3	37 39.4	30.2	145 00.5	13.3	339 09.6	08.7
I 11	194 33.0	331 45.9	12.3	52 40.5	29.8	160 03.3	13.2	354 11.8	08.8
D 12	209 35.4	346 45.3	S16 13.3	67 41.6	N16 29.4	175 06.1	N12 13.1	9 14.0	S 6 08.9
A 13	224 37.9	1 44.7	14.4	82 42.6	29.0	190 08.9	13.0	24 16.2	09.0
Y 14	239 40.4	16 44.1	15.4	97 43.7	28.6	205 11.7	12.9	39 18.4	09.1
15	254 42.8	31 43.5	16.4	112 44.8	28.2	220 14.5	12.8	54 20.5	09.2
16	269 45.3	46 42.9	17.4	127 45.9	27.8	235 17.2	12.7	69 22.7	09.3
17	284 47.7	61 42.3	18.4	142 46.9	27.4	250 20.0	12.6	84 24.9	09.4
18	299 50.2	76 41.7	S16 19.4	157 48.0	N16 27.0	265 22.8	N12 12.4	99 27.1	S 6 09.6
19	314 52.7	91 41.1	20.4	172 49.1	26.6	280 25.6	12.3	114 29.3	09.7
20	329 55.1	106 40.5	21.4	187 50.2	26.2	295 28.4	12.2	129 31.4	09.8
21	344 57.6	121 39.9	22.4	202 51.2	25.8	310 31.2	12.1	144 33.6	09.9
22	0 00.1	136 39.3	23.4	217 52.3	25.4	325 34.0	12.0	159 35.8	10.0
23	15 02.5	151 38.7	24.4	232 53.4	25.0	340 36.8	11.9	174 38.0	10.1
	h m								
Mer. Pass.	22 03.9	v −0.6	d 1.0	v 1.1	d 0.4	v 2.8	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.3
Achernar	335 27.0	S57 10.5
Acrux	173 11.3	S63 09.8
Adhara	255 13.4	S28 59.1
Aldebaran	290 50.5	N16 32.0
Alioth	166 22.2	N55 53.7
Alkaid	153 00.3	N49 15.3
Al Na'ir	27 44.9	S46 54.2
Alnilam	275 47.4	S 1 11.6
Alphard	217 57.4	S 8 42.5
Alphecca	126 12.3	N26 40.7
Alpheratz	357 44.4	N29 09.6
Altair	62 09.4	N 8 54.3
Ankaa	353 16.4	S42 14.4
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.3
Atria	107 31.3	S69 03.0
Avior	234 18.6	S59 32.6
Bellatrix	278 33.1	N 6 21.7
Betelgeuse	271 02.4	N 7 24.6
Canopus	263 56.5	S52 41.9
Capella	280 35.9	N46 00.4
Deneb	49 32.2	N45 19.8
Denebola	182 35.1	N14 30.3
Diphda	348 56.7	S17 55.1
Dubhe	193 53.6	N61 41.0
Elnath	278 13.9	N28 37.0
Eltanin	90 46.9	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.5
Gacrux	172 02.8	S57 10.7
Gienah	175 53.8	S17 36.4
Hadar	148 50.3	S60 25.8
Hamal	328 01.8	N23 31.2
Kaus Aust.	83 45.5	S34 22.7
Kochab	137 21.0	N74 06.5
Markab	13 39.3	N15 16.4
Menkar	314 16.0	N 4 08.3
Menkent	148 09.4	S36 25.6
Miaplacidus	221 40.3	S69 45.7
Mirfak	308 41.6	N49 54.2
Nunki	75 59.9	S26 16.8
Peacock	53 21.0	S56 41.9
Pollux	243 29.1	N27 59.7
Procyon	245 00.9	N 5 11.7
Rasalhague	96 07.7	N12 33.3
Regulus	207 44.9	N11 54.5
Rigel	281 13.0	S 8 11.2
Rigil Kent.	139 54.0	S60 53.0
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.4
Shaula	96 23.8	S37 06.7
Sirius	258 34.6	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.5	S43 28.6
Vega	80 39.9	N38 48.0
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	138 59.9	12 52
Mars	218 56.4	7 31
Jupiter	325 19.2	0 26
Saturn	159 48.8	11 27

2011 OCTOBER 19, 20, 21 (WED., THURS., FRI.)

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
19 00	183 43.4	S 9 46.2	284 39.9	10.0	N20 39.3	5.3	56.1
01	198 43.5	47.1	299 08.9	10.1	20 34.0	5.5	56.2
02	213 43.6	48.0	313 38.0	10.1	20 28.5	5.5	56.2
03	228 43.7	. . 48.9	328 07.1	10.0	20 23.0	5.7	56.2
04	243 43.9	49.8	342 36.1	10.1	20 17.3	5.7	56.3
05	258 44.0	50.8	357 05.2	10.1	20 11.6	5.9	56.3
06	273 44.1	S 9 51.7	11 34.3	10.0	N20 05.7	6.0	56.3
W 07	288 44.2	52.6	26 03.3	10.1	19 59.7	6.1	56.4
E 08	303 44.3	53.5	40 32.4	10.1	19 53.6	6.2	56.4
D 09	318 44.4	. . 54.4	55 01.5	10.1	19 47.4	6.3	56.4
N 10	333 44.6	55.3	69 30.6	10.1	19 41.1	6.4	56.4
E 11	348 44.7	56.2	83 59.7	10.2	19 34.7	6.6	56.5
S 12	3 44.8	S 9 57.1	98 28.9	10.1	N19 28.1	6.6	56.5
D 13	18 44.9	58.0	112 58.0	10.1	19 21.5	6.8	56.5
A 14	33 45.0	58.9	127 27.1	10.2	19 14.7	6.8	56.6
Y 15	48 45.1	9 59.8	141 56.3	10.1	19 07.9	7.0	56.6
16	63 45.2	10 00.7	156 25.4	10.2	19 00.9	7.1	56.6
17	78 45.4	01.6	170 54.6	10.1	18 53.8	7.1	56.7
18	93 45.5	S10 02.5	185 23.7	10.2	N18 46.7	7.3	56.7
19	108 45.6	03.4	199 52.9	10.2	18 39.4	7.4	56.7
20	123 45.7	04.3	214 22.1	10.2	18 32.0	7.5	56.8
21	138 45.8	. . 05.2	228 51.3	10.2	18 24.5	7.6	56.8
22	153 45.9	06.1	243 20.5	10.2	18 16.9	7.8	56.8
23	168 46.0	07.0	257 49.7	10.2	18 09.1	7.8	56.9
20 00	183 46.2	S10 07.9	272 18.9	10.2	N18 01.3	7.9	56.9
01	198 46.3	08.8	286 48.1	10.3	17 53.4	8.0	56.9
02	213 46.4	09.7	301 17.4	10.2	17 45.4	8.2	57.0
03	228 46.5	. . 10.6	315 46.6	10.3	17 37.2	8.2	57.0
04	243 46.6	11.5	330 15.9	10.2	17 29.0	8.3	57.1
05	258 46.7	12.4	344 45.1	10.3	17 20.7	8.5	57.1
06	273 46.8	S10 13.3	359 14.4	10.3	N17 12.2	8.5	57.1
T 07	288 46.9	14.2	13 43.7	10.3	17 03.7	8.6	57.2
H 08	303 47.0	15.1	28 13.0	10.3	16 55.1	8.8	57.2
U 09	318 47.2	. . 16.0	42 42.3	10.3	16 46.3	8.8	57.2
R 10	333 47.3	16.9	57 11.6	10.3	16 37.5	8.9	57.3
S 11	348 47.4	17.8	71 40.9	10.4	16 28.6	9.1	57.3
D 12	3 47.5	S10 18.7	86 10.3	10.3	N16 19.5	9.1	57.3
A 13	18 47.6	19.6	100 39.6	10.4	16 10.4	9.2	57.4
Y 14	33 47.7	20.5	115 09.0	10.3	16 01.2	9.4	57.4
15	48 47.8	. . 21.4	129 38.3	10.4	15 51.8	9.4	57.4
16	63 47.9	22.3	144 07.7	10.4	15 42.4	9.5	57.5
17	78 48.0	23.2	158 37.1	10.3	15 32.9	9.6	57.5
18	93 48.1	S10 24.1	173 06.4	10.4	N15 23.3	9.7	57.6
19	108 48.2	25.0	187 35.8	10.4	15 13.6	9.8	57.6
20	123 48.3	25.9	202 05.2	10.4	15 03.8	9.9	57.6
21	138 48.4	. . 26.7	216 34.6	10.4	14 53.9	10.0	57.7
22	153 48.6	27.6	231 04.0	10.5	14 43.9	10.1	57.7
23	168 48.7	28.5	245 33.5	10.4	14 33.8	10.1	57.7
21 00	183 48.8	S10 29.4	260 02.9	10.4	N14 23.7	10.3	57.8
01	198 48.9	30.3	274 32.3	10.5	14 13.4	10.3	57.8
02	213 49.0	31.2	289 01.8	10.4	14 03.1	10.5	57.9
03	228 49.1	. . 32.1	303 31.2	10.4	13 52.6	10.5	57.9
04	243 49.2	33.0	318 00.6	10.5	13 42.1	10.6	57.9
05	258 49.3	33.9	332 30.1	10.5	13 31.5	10.7	58.0
06	273 49.4	S10 34.8	346 59.6	10.4	N13 20.8	10.8	58.0
07	288 49.5	35.7	1 29.0	10.5	13 10.0	10.8	58.1
08	303 49.6	36.6	15 58.5	10.5	12 59.2	11.0	58.1
F 09	318 49.7	. . 37.5	30 28.0	10.4	12 48.2	11.0	58.1
R 10	333 49.8	38.4	44 57.4	10.5	12 37.2	11.1	58.2
I 11	348 49.9	39.2	59 26.9	10.5	12 26.1	11.2	58.2
D 12	3 50.0	S10 40.1	73 56.4	10.5	N12 14.9	11.3	58.2
A 13	18 50.1	41.0	88 25.9	10.4	12 03.6	11.4	58.3
Y 14	33 50.2	41.9	102 55.3	10.5	11 52.2	11.4	58.3
15	48 50.3	. . 42.8	117 24.8	10.5	11 40.8	11.5	58.4
16	63 50.4	43.7	131 54.3	10.5	11 29.3	11.6	58.4
17	78 50.5	44.6	146 23.8	10.5	11 17.7	11.7	58.4
18	93 50.6	S10 45.5	160 53.3	10.4	N11 06.0	11.7	58.5
19	108 50.7	46.4	175 22.7	10.5	10 54.3	11.8	58.5
20	123 50.8	47.3	189 52.2	10.5	10 42.5	11.9	58.6
21	138 50.9	. . 48.1	204 21.7	10.5	10 30.6	12.0	58.6
22	153 51.0	49.0	218 51.2	10.4	10 18.6	12.0	58.6
23	168 51.1	49.9	233 20.6	10.5	N10 06.6	12.1	58.7
	SD 16.1	d 0.9	SD	15.4		15.6	15.9

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 19	Moonrise 20	Moonrise 21	Moonrise 22
	h m	h m	h m	h m	h m	h m	h m
N 72	05 15	06 34	07 47	▭	20 57	23 17	25 28
N 70	05 17	06 28	07 33	19 13	21 31	23 34	25 34
68	05 18	06 22	07 21	20 01	21 55	23 47	25 39
66	05 19	06 18	07 12	20 31	22 14	23 58	25 43
64	05 19	06 14	07 04	20 54	22 29	24 07	00 07
62	05 19	06 11	06 57	21 12	22 41	24 14	00 14
60	05 20	06 08	06 51	21 26	22 52	24 21	00 21
N 58	05 20	06 05	06 45	21 39	23 01	24 26	00 26
56	05 19	06 03	06 41	21 50	23 09	24 31	00 31
54	05 19	06 00	06 36	21 59	23 16	24 36	00 36
52	05 19	05 58	06 33	22 08	23 22	24 40	00 40
50	05 19	05 56	06 29	22 15	23 28	24 44	00 44
45	05 18	05 52	06 22	22 32	23 40	24 52	00 52
N 40	05 16	05 48	06 15	22 45	23 50	24 58	00 58
35	05 15	05 44	06 10	22 56	23 59	25 04	01 04
30	05 13	05 41	06 05	23 06	24 07	00 07	01 09
20	05 08	05 34	05 56	23 23	24 20	00 20	01 18
N 10	05 03	05 27	05 49	23 37	24 31	00 31	01 25
0	04 56	05 20	05 41	23 51	24 42	00 42	01 32
S 10	04 48	05 13	05 34	24 05	00 05	00 52	01 39
20	04 37	05 04	05 26	24 19	00 19	01 04	01 47
30	04 23	04 53	05 17	24 36	00 36	01 17	01 55
35	04 15	04 46	05 12	00 03	00 45	01 24	02 00
40	04 04	04 38	05 06	00 16	00 56	01 32	02 06
45	03 51	04 28	04 59	00 32	01 09	01 42	02 12
S 50	03 33	04 16	04 50	00 50	01 25	01 54	02 20
52	03 25	04 10	04 46	00 59	01 32	02 00	02 24
54	03 16	04 03	04 42	01 09	01 40	02 06	02 27
56	03 05	03 56	04 37	01 20	01 49	02 12	02 32
58	02 52	03 48	04 31	01 33	01 59	02 20	02 36
S 60	02 36	03 39	04 25	01 48	02 11	02 28	02 42

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 19	Moonset 20	Moonset 21	Moonset 22
	h m	h m	h m	h m	h m	h m	h m
N 72	15 41	16 54	18 12	▭	16 19	15 45	15 22
N 70	15 55	17 00	18 11	16 14	15 44	15 26	15 13
68	16 07	17 06	18 10	15 26	15 18	15 12	15 06
66	16 17	17 10	18 09	14 55	14 58	14 59	14 59
64	16 25	17 14	18 09	14 32	14 42	14 49	14 54
62	16 32	17 18	18 09	14 13	14 29	14 40	14 49
60	16 38	17 21	18 09	13 58	14 18	14 33	14 45
N 58	16 43	17 23	18 09	13 45	14 08	14 26	14 42
56	16 48	17 26	18 09	13 33	13 59	14 20	14 38
54	16 52	17 28	18 09	13 23	13 51	14 15	14 35
52	16 56	17 31	18 10	13 14	13 44	14 10	14 33
50	17 00	17 33	18 10	13 06	13 38	14 06	14 30
45	17 07	17 37	18 11	12 49	13 25	13 56	14 25
N 40	17 14	17 41	18 13	12 35	13 13	13 48	14 20
35	17 19	17 45	18 15	12 23	13 04	13 41	14 16
30	17 24	17 49	18 17	12 13	12 55	13 35	14 13
20	17 33	17 55	18 21	11 55	12 40	13 24	14 07
N 10	17 41	18 02	18 27	11 39	12 27	13 15	14 02
0	17 48	18 09	18 34	11 24	12 15	13 06	13 56
S 10	17 56	18 17	18 42	11 09	12 03	12 57	13 51
20	18 04	18 26	18 53	10 53	11 50	12 47	13 46
30	18 13	18 38	19 07	10 35	11 35	12 36	13 39
35	18 19	18 45	19 16	10 24	11 26	12 30	13 36
40	18 25	18 53	19 27	10 12	11 16	12 23	13 32
45	18 32	19 03	19 40	09 57	11 04	12 14	13 27
S 50	18 41	19 15	19 58	09 39	10 49	12 04	13 21
52	18 45	19 21	20 06	09 31	10 42	11 59	13 18
54	18 49	19 28	20 16	09 21	10 35	11 53	13 15
56	18 54	19 35	20 27	09 10	10 26	11 47	13 12
58	19 00	19 43	20 41	08 58	10 17	11 41	13 08
S 60	19 06	19 53	20 56	08 44	10 06	11 33	13 04

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
	m s	m s	h m	h m	h m	d	%
19	14 53	14 59	11 45	05 12	17 38	22	57
20	15 04	15 10	11 45	06 03	18 29	23	46
21	15 15	15 20	11 45	06 54	19 19	24	36

UT	ARIES	VENUS −3.8		MARS +1.2		JUPITER −2.9		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
22 00	30 05.0	166 38.1	S16 25.4	247 54.5	N16 24.6	355 39.5	N12 11.8	189 40.2	S 6 10.2
01	45 07.5	181 37.5	26.4	262 55.6	24.2	10 42.3	11.7	204 42.3	10.3
02	60 09.9	196 36.9	27.4	277 56.6	23.8	25 45.1	11.6	219 44.5	10.5
03	75 12.4	211 36.3	28.4	292 57.7	23.4	40 47.9	11.5	234 46.7	10.6
04	90 14.9	226 35.7	29.4	307 58.8	23.0	55 50.7	11.4	249 48.9	10.7
05	105 17.3	241 35.1	30.4	322 59.9	22.6	70 53.5	11.3	264 51.1	10.8
06	120 19.8	256 34.4	S16 31.3	338 00.9	N16 22.2	85 56.3	N12 11.1	279 53.2	S 6 10.9
07	135 22.2	271 33.8	32.3	353 02.0	21.8	100 59.0	11.0	294 55.4	11.0
S 08	150 24.7	286 33.2	33.3	8 03.1	21.4	116 01.8	10.9	309 57.6	11.1
A 09	165 27.2	301 32.6	34.3	23 04.2	21.0	131 04.6	10.8	324 59.8	11.2
T 10	180 29.6	316 32.0	35.3	38 05.3	20.6	146 07.4	10.7	340 02.0	11.3
U 11	195 32.1	331 31.4	36.3	53 06.3	20.2	161 10.2	10.6	355 04.1	11.5
R 12	210 34.6	346 30.8	S16 37.3	68 07.4	N16 19.8	176 13.0	N12 10.5	10 06.3	S 6 11.6
D 13	225 37.0	1 30.2	38.3	83 08.5	19.4	191 15.8	10.4	25 08.5	11.7
A 14	240 39.5	16 29.5	39.3	98 09.6	19.0	206 18.6	10.3	40 10.7	11.8
Y 15	255 42.0	31 28.9	40.3	113 10.7	18.6	221 21.3	10.2	55 12.9	11.9
16	270 44.4	46 28.3	41.2	128 11.7	18.2	236 24.1	10.1	70 15.0	12.0
17	285 46.9	61 27.7	42.2	143 12.8	17.8	251 26.9	09.9	85 17.2	12.1
18	300 49.3	76 27.1	S16 43.2	158 13.9	N16 17.4	266 29.7	N12 09.8	100 19.4	S 6 12.2
19	315 51.8	91 26.5	44.2	173 15.0	17.0	281 32.5	09.7	115 21.6	12.4
20	330 54.3	106 25.8	45.2	188 16.1	16.6	296 35.3	09.6	130 23.8	12.5
21	345 56.7	121 25.2	46.2	203 17.2	16.2	311 38.1	09.5	145 25.9	12.6
22	0 59.2	136 24.6	47.2	218 18.2	15.8	326 40.9	09.4	160 28.1	12.7
23	16 01.7	151 24.0	48.1	233 19.3	15.4	341 43.7	09.3	175 30.3	12.8
23 00	31 04.1	166 23.4	S16 49.1	248 20.4	N16 15.0	356 46.4	N12 09.2	190 32.5	S 6 12.9
01	46 06.6	181 22.7	50.1	263 21.5	14.6	11 49.2	09.1	205 34.7	13.0
02	61 09.1	196 22.1	51.1	278 22.6	14.2	26 52.0	09.0	220 36.8	13.1
03	76 11.5	211 21.5	52.1	293 23.7	13.8	41 54.8	08.9	235 39.0	13.2
04	91 14.0	226 20.9	53.0	308 24.8	13.4	56 57.6	08.7	250 41.2	13.4
05	106 16.5	241 20.3	54.0	323 25.8	13.0	72 00.4	08.6	265 43.4	13.5
06	121 18.9	256 19.6	S16 55.0	338 26.9	N16 12.6	87 03.2	N12 08.5	280 45.6	S 6 13.6
07	136 21.4	271 19.0	56.0	353 28.0	12.2	102 06.0	08.4	295 47.7	13.7
08	151 23.8	286 18.4	56.9	8 29.1	11.8	117 08.8	08.3	310 49.9	13.8
S 09	166 26.3	301 17.8	57.9	23 30.2	11.4	132 11.5	08.2	325 52.1	13.9
U 10	181 28.8	316 17.1	58.9	38 31.3	11.0	147 14.3	08.1	340 54.3	14.0
N 11	196 31.2	331 16.5	16 59.9	53 32.4	10.6	162 17.1	08.0	355 56.5	14.1
D 12	211 33.7	346 15.9	S17 00.8	68 33.4	N16 10.2	177 19.9	N12 07.9	10 58.6	S 6 14.3
A 13	226 36.2	1 15.3	01.8	83 34.5	09.8	192 22.7	07.8	26 00.8	14.4
Y 14	241 38.6	16 14.6	02.8	98 35.6	09.4	207 25.5	07.7	41 03.0	14.5
15	256 41.1	31 14.0	03.7	113 36.7	09.0	222 28.3	07.5	56 05.2	14.6
16	271 43.6	46 13.4	04.7	128 37.8	08.6	237 31.1	07.4	71 07.4	14.7
17	286 46.0	61 12.8	05.7	143 38.9	08.2	252 33.9	07.3	86 09.6	14.8
18	301 48.5	76 12.1	S17 06.6	158 40.0	N16 07.8	267 36.6	N12 07.2	101 11.7	S 6 14.9
19	316 50.9	91 11.5	07.6	173 41.1	07.4	282 39.4	07.1	116 13.9	15.0
20	331 53.4	106 10.9	08.6	188 42.2	07.0	297 42.2	07.0	131 16.1	15.1
21	346 55.9	121 10.2	09.5	203 43.3	06.6	312 45.0	06.9	146 18.3	15.3
22	1 58.3	136 09.6	10.5	218 44.3	06.2	327 47.8	06.8	161 20.5	15.4
23	17 00.8	151 09.0	11.5	233 45.4	05.8	342 50.6	06.7	176 22.6	15.5
24 00	32 03.3	166 08.3	S17 12.4	248 46.5	N16 05.4	357 53.4	N12 06.6	191 24.8	S 6 15.6
01	47 05.7	181 07.7	13.4	263 47.6	05.0	12 56.2	06.5	206 27.0	15.7
02	62 08.2	196 07.1	14.3	278 48.7	04.6	27 59.0	06.3	221 29.2	15.8
03	77 10.7	211 06.4	15.3	293 49.8	04.2	43 01.7	06.2	236 31.4	15.9
04	92 13.1	226 05.8	16.3	308 50.9	03.8	58 04.5	06.1	251 33.5	16.0
05	107 15.6	241 05.2	17.2	323 52.0	03.4	73 07.3	06.0	266 35.7	16.1
06	122 18.1	256 04.5	S17 18.2	338 53.1	N16 03.0	88 10.1	N12 05.9	281 37.9	S 6 16.3
07	137 20.5	271 03.9	19.1	353 54.2	02.6	103 12.9	05.8	296 40.1	16.4
08	152 23.0	286 03.3	20.1	8 55.3	02.2	118 15.7	05.7	311 42.3	16.5
M 09	167 25.4	301 02.6	21.1	23 56.4	01.8	133 18.5	05.6	326 44.4	16.6
O 10	182 27.9	316 02.0	22.0	38 57.5	01.4	148 21.3	05.5	341 46.6	16.7
N 11	197 30.4	331 01.3	23.0	53 58.6	01.0	163 24.1	05.4	356 48.8	16.8
D 12	212 32.8	346 00.7	S17 23.9	68 59.7	N16 00.6	178 26.9	N12 05.2	11 51.0	S 6 16.9
A 13	227 35.3	1 00.1	24.9	84 00.8	16 00.2	193 29.7	05.1	26 53.2	17.0
Y 14	242 37.8	15 59.4	25.8	99 01.8	15 59.8	208 32.4	05.0	41 55.3	17.1
15	257 40.2	30 58.8	26.8	114 02.9	59.4	223 35.2	04.9	56 57.5	17.3
16	272 42.7	45 58.1	27.7	129 04.0	59.0	238 38.0	04.8	71 59.7	17.4
17	287 45.2	60 57.5	28.7	144 05.1	58.6	253 40.8	04.7	87 01.9	17.5
18	302 47.6	75 56.9	S17 29.6	159 06.2	N15 58.2	268 43.6	N12 04.6	102 04.1	S 6 17.6
19	317 50.1	90 56.2	30.6	174 07.3	57.8	283 46.4	04.5	117 06.3	17.7
20	332 52.6	105 55.6	31.5	189 08.4	57.4	298 49.2	04.4	132 08.4	17.8
21	347 55.0	120 54.9	32.5	204 09.5	57.0	313 52.0	04.3	147 10.6	17.9
22	2 57.5	135 54.3	33.4	219 10.6	56.6	328 54.8	04.1	162 12.8	18.0
23	17 59.9	150 53.6	34.3	234 11.7	56.2	343 57.6	04.0	177 15.0	18.1
	h m								
Mer. Pass.	21 52.1	*v* −0.6	*d* 1.0	*v* 1.1	*d* 0.4	*v* 2.8	*d* 0.1	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.3
Achernar	335 27.0	S57 10.5
Acrux	173 11.3	S63 09.8
Adhara	255 13.3	S28 59.1
Aldebaran	290 50.5	N16 32.0
Alioth	166 22.2	N55 53.6
Alkaid	153 00.3	N49 15.2
Al Na'ir	27 44.9	S46 54.2
Alnilam	275 47.4	S 1 11.6
Alphard	217 57.4	S 8 42.6
Alphecca	126 12.3	N26 40.6
Alpheratz	357 44.4	N29 09.6
Altair	62 09.4	N 8 54.3
Ankaa	353 16.4	S42 14.4
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.3
Atria	107 31.3	S69 03.0
Avior	234 18.6	S59 32.6
Bellatrix	278 33.1	N 6 21.6
Betelgeuse	271 02.4	N 7 24.6
Canopus	263 56.4	S52 41.9
Capella	280 35.9	N46 00.4
Deneb	49 32.2	N45 19.8
Denebola	182 35.1	N14 30.3
Diphda	348 56.7	S17 55.1
Dubhe	193 53.5	N61 41.0
Elnath	278 13.9	N28 37.0
Eltanin	90 47.0	N51 29.6
Enif	33 48.1	N 9 56.0
Fomalhaut	15 25.0	S29 33.5
Gacrux	172 02.8	S57 10.7
Gienah	175 53.8	S17 36.4
Hadar	148 50.3	S60 25.8
Hamal	328 01.8	N23 31.2
Kaus Aust.	83 45.5	S34 22.7
Kochab	137 21.0	N74 06.5
Markab	13 39.3	N15 16.4
Menkar	314 16.0	N 4 08.3
Menkent	148 09.4	S36 25.6
Miaplacidus	221 40.3	S69 45.7
Mirfak	308 41.6	N49 54.2
Nunki	75 59.9	S26 16.8
Peacock	53 21.0	S56 41.9
Pollux	243 29.1	N27 59.7
Procyon	245 00.9	N 5 11.7
Rasalhague	96 07.7	N12 33.3
Regulus	207 44.9	N11 54.5
Rigel	281 13.0	S 8 11.2
Rigil Kent.	139 54.0	S60 53.0
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.4
Shaula	96 23.8	S37 06.7
Sirius	258 34.6	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.5	S43 28.6
Vega	80 39.9	N38 48.0
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	135 19.2	12 55
Mars	217 16.3	7 26
Jupiter	325 42.3	0 13
Saturn	159 28.4	11 16

2011 OCTOBER 22, 23, 24 (SAT., SUN., MON.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
22 00	183 51.2	S10 50.8	247 50.1	10.5 N	9 54.5	12.2	58.7
01	198 51.3	51.7	262 19.6	10.4	9 42.3	12.3	58.7
02	213 51.4	52.6	276 49.0	10.5	9 30.0	12.3	58.8
03	228 51.5	. . 53.5	291 18.5	10.4	9 17.7	12.4	58.8
04	243 51.6	54.4	305 47.9	10.4	9 05.3	12.4	58.9
05	258 51.7	55.2	320 17.3	10.5	8 52.9	12.6	58.9
06	273 51.8	S10 56.1	334 46.8	10.4 N	8 40.3	12.5	58.9
07	288 51.9	57.0	349 16.2	10.4	8 27.8	12.7	59.0
S 08	303 52.0	57.9	3 45.6	10.4	8 15.1	12.7	59.0
A 09	318 52.1	. . 58.8	18 15.0	10.4	8 02.4	12.8	59.1
T 10	333 52.2	10 59.7	32 44.4	10.4	7 49.6	12.8	59.1
U 11	348 52.3	11 00.6	47 13.8	10.3	7 36.8	12.9	59.1
R 12	3 52.4	S11 01.4	61 43.1	10.4 N	7 23.9	12.9	59.2
D 13	18 52.5	02.3	76 12.5	10.3	7 11.0	13.0	59.2
A 14	33 52.6	03.2	90 41.8	10.4	6 58.0	13.1	59.2
Y 15	48 52.7	. . 04.1	105 11.2	10.3	6 44.9	13.1	59.3
16	63 52.7	05.0	119 40.5	10.3	6 31.8	13.1	59.3
17	78 52.8	05.9	134 09.8	10.3	6 18.7	13.3	59.4
18	93 52.9	S11 06.7	148 39.1	10.2 N	6 05.4	13.2	59.4
19	108 53.0	07.6	163 08.3	10.3	5 52.2	13.4	59.4
20	123 53.1	08.5	177 37.6	10.2	5 38.8	13.3	59.5
21	138 53.2	. . 09.4	192 06.8	10.2	5 25.5	13.4	59.5
22	153 53.3	10.3	206 36.0	10.2	5 12.1	13.5	59.5
23	168 53.4	11.1	221 05.2	10.2	4 58.6	13.5	59.6
23 00	183 53.5	S11 12.0	235 34.4	10.2 N	4 45.1	13.6	59.6
01	198 53.6	12.9	250 03.6	10.1	4 31.5	13.5	59.6
02	213 53.7	13.8	264 32.7	10.1	4 18.0	13.7	59.7
03	228 53.8	. . 14.7	279 01.8	10.1	4 04.3	13.7	59.7
04	243 53.8	15.5	293 30.9	10.0	3 50.6	13.7	59.8
05	258 53.9	16.4	307 59.9	10.1	3 36.9	13.7	59.8
06	273 54.0	S11 17.3	322 29.0	10.0 N	3 23.2	13.8	59.8
07	288 54.1	18.2	336 58.0	10.0	3 09.4	13.8	59.9
08	303 54.2	19.1	351 27.0	9.9	2 55.6	13.9	59.9
S 09	318 54.3	. . 19.9	5 55.9	9.9	2 41.7	13.9	59.9
U 10	333 54.4	20.8	20 24.8	9.9	2 27.8	13.9	60.0
N 11	348 54.5	21.7	34 53.7	9.9	2 13.9	13.9	60.0
D 12	3 54.6	S11 22.6	49 22.6	9.8 N	2 00.0	14.0	60.0
A 13	18 54.6	23.4	63 51.4	9.8	1 46.0	14.0	60.1
Y 14	33 54.7	24.3	78 20.2	9.8	1 32.0	14.0	60.1
15	48 54.8	. . 25.2	92 49.0	9.7	1 18.0	14.1	60.1
16	63 54.9	26.1	107 17.7	9.7	1 03.9	14.1	60.2
17	78 55.0	27.0	121 46.4	9.7	0 49.8	14.1	60.2
18	93 55.1	S11 27.8	136 15.1	9.6 N	0 35.7	14.1	60.2
19	108 55.2	28.7	150 43.7	9.6	0 21.6	14.1	60.3
20	123 55.2	29.6	165 12.3	9.6 N	0 07.5	14.2	60.3
21	138 55.3	. . 30.5	179 40.9	9.5 S	0 06.7	14.1	60.3
22	153 55.4	31.3	194 09.4	9.5	0 20.8	14.2	60.4
23	168 55.5	32.2	208 37.9	9.4	0 35.0	14.2	60.4
24 00	183 55.6	S11 33.1	223 06.3	9.4 S	0 49.2	14.2	60.4
01	198 55.7	33.9	237 34.7	9.4	1 03.4	14.2	60.4
02	213 55.8	34.8	252 03.1	9.3	1 17.6	14.2	60.5
03	228 55.8	. . 35.7	266 31.4	9.3	1 31.8	14.2	60.5
04	243 55.9	36.6	280 59.7	9.2	1 46.0	14.2	60.5
05	258 56.0	37.4	295 27.9	9.2	2 00.2	14.3	60.6
06	273 56.1	S11 38.3	309 56.1	9.1 S	2 14.5	14.2	60.6
07	288 56.2	39.2	324 24.2	9.1	2 28.7	14.2	60.6
08	303 56.2	40.0	338 52.3	9.1	2 42.9	14.2	60.6
M 09	318 56.3	. . 40.9	353 20.4	9.0	2 57.1	14.2	60.7
O 10	333 56.4	41.8	7 48.4	8.9	3 11.3	14.3	60.7
N 11	348 56.5	42.7	22 16.3	8.9	3 25.6	14.2	60.7
D 12	3 56.6	S11 43.5	36 44.2	8.9 S	3 39.8	14.1	60.8
A 13	18 56.6	44.4	51 12.1	8.8	3 53.9	14.2	60.8
Y 14	33 56.7	45.3	65 39.9	8.7	4 08.1	14.2	60.8
15	48 56.8	. . 46.1	80 07.6	8.7	4 22.3	14.2	60.8
16	63 56.9	47.0	94 35.3	8.7	4 36.5	14.1	60.9
17	78 57.0	47.9	109 03.0	8.6	4 50.6	14.1	60.9
18	93 57.0	S11 48.7	123 30.6	8.5 S	5 04.7	14.1	60.9
19	108 57.1	49.6	137 58.1	8.5	5 18.8	14.1	60.9
20	123 57.2	50.5	152 25.6	8.4	5 32.9	14.0	60.9
21	138 57.3	. . 51.3	166 53.0	8.4	5 46.9	14.1	61.0
22	153 57.4	52.2	181 20.4	8.3	6 01.0	14.0	61.0
23	168 57.4	53.1	195 47.7	8.3 S	6 15.0	13.9	61.0
	SD 16.1	d 0.9	SD	16.1		16.4	16.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 22	Moonrise 23	Moonrise 24	Moonrise 25
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 28	06 47	08 03	25 28	01 28	03 38	05 55
N 70	05 28	06 39	07 46	25 34	01 34	03 36	05 42
68	05 28	06 33	07 33	25 39	01 39	03 33	05 32
66	05 28	06 27	07 22	25 43	01 43	03 32	05 24
64	05 27	06 23	07 13	00 07	01 47	03 30	05 17
62	05 27	06 19	07 05	00 14	01 50	03 29	05 11
60	05 26	06 15	06 58	00 21	01 53	03 28	05 06
N 58	05 26	06 12	06 52	00 26	01 55	03 27	05 01
56	05 25	06 09	06 47	00 31	01 57	03 26	04 57
54	05 25	06 06	06 42	00 36	01 59	03 25	04 53
52	05 24	06 03	06 38	00 40	02 01	03 24	04 50
50	05 23	06 01	06 34	00 44	02 02	03 24	04 47
45	05 21	05 56	06 26	00 52	02 06	03 22	04 41
N 40	05 19	05 51	06 18	00 58	02 09	03 21	04 36
35	05 17	05 47	06 12	01 04	02 11	03 20	04 31
30	05 15	05 43	06 07	01 09	02 13	03 19	04 27
20	05 09	05 35	05 57	01 18	02 17	03 18	04 20
N 10	05 03	05 28	05 49	01 25	02 20	03 16	04 14
0	04 55	05 20	05 41	01 32	02 23	03 15	04 09
S 10	04 46	05 11	05 33	01 39	02 26	03 14	04 03
20	04 35	05 02	05 24	01 47	02 30	03 13	03 58
30	04 20	04 49	05 14	01 55	02 33	03 11	03 51
35	04 11	04 42	05 08	02 00	02 35	03 11	03 47
40	03 59	04 33	05 01	02 06	02 38	03 10	03 43
45	03 45	04 22	04 54	02 12	02 41	03 09	03 38
S 50	03 26	04 09	04 44	02 20	02 44	03 08	03 33
52	03 17	04 03	04 40	02 24	02 46	03 07	03 30
54	03 07	03 56	04 35	02 27	02 47	03 07	03 27
56	02 55	03 48	04 29	02 32	02 49	03 06	03 24
58	02 41	03 39	04 23	02 36	02 51	03 05	03 21
S 60	02 24	03 29	04 16	02 42	02 53	03 05	03 17

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 22	Moonset 23	Moonset 24	Moonset 25
°	h m	h m	h m	h m	h m	h m	h m
N 72	15 24	16 40	17 59	15 22	15 03	14 43	14 20
N 70	15 41	16 48	17 59	15 13	15 01	14 49	14 36
68	15 55	16 54	17 59	15 06	15 00	14 54	14 48
66	16 06	17 00	17 59	14 59	14 59	14 58	14 58
64	16 15	17 05	18 00	14 54	14 58	15 02	15 07
62	16 23	17 09	18 00	14 49	14 57	15 05	15 14
60	16 29	17 13	18 01	14 45	14 56	15 08	15 21
N 58	16 35	17 16	18 02	14 42	14 56	15 10	15 26
56	16 41	17 19	18 02	14 38	14 55	15 12	15 31
54	16 46	17 22	18 03	14 35	14 55	15 14	15 36
52	16 50	17 25	18 04	14 33	14 54	15 16	15 40
50	16 54	17 27	18 05	14 30	14 54	15 18	15 44
45	17 02	17 32	18 07	14 25	14 53	15 21	15 52
N 40	17 10	17 37	18 09	14 20	14 52	15 24	15 59
35	17 16	17 42	18 11	14 16	14 51	15 27	16 05
30	17 21	17 46	18 14	14 13	14 51	15 29	16 10
20	17 31	17 53	18 19	14 07	14 50	15 33	16 19
N 10	17 40	18 01	18 26	14 02	14 49	15 37	16 28
0	17 48	18 09	18 33	13 56	14 48	15 40	16 35
S 10	17 56	18 17	18 43	13 51	14 47	15 44	16 43
20	18 05	18 28	18 54	13 46	14 46	15 47	16 51
30	18 15	18 40	19 09	13 39	14 44	15 51	17 00
35	18 21	18 48	19 19	13 36	14 44	15 53	17 05
40	18 28	18 56	19 31	13 32	14 43	15 56	17 12
45	18 36	19 07	19 45	13 27	14 42	15 59	17 19
S 50	18 46	19 21	20 04	13 21	14 40	16 03	17 27
52	18 50	19 27	20 13	13 18	14 40	16 04	17 31
54	18 55	19 34	20 24	13 15	14 39	16 06	17 36
56	19 01	19 42	20 36	13 12	14 39	16 08	17 41
58	19 07	19 51	20 51	13 08	14 38	16 11	17 46
S 60	19 14	20 02	21 08	13 04	14 37	16 13	17 52

Day	SUN Eqn. of Time 00^h	SUN Eqn. of Time 12^h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
22	15 25	15 29	11 45	07 44	20 10	25	25
23	15 34	15 38	11 44	08 35	21 01	26	16
24	15 42	15 46	11 44	09 28	21 54	27	8

UT	ARIES	VENUS −3.8		MARS +1.1		JUPITER −2.9		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
25 00	33 02.4	165 53.0	S17 35.3	249 12.8	N15 55.8	359 00.3	N12 03.9	192 17.2	S 6 18.3
01	48 04.9	180 52.4	36.2	264 13.9	55.4	14 03.1	03.8	207 19.3	18.4
02	63 07.3	195 51.7	37.2	279 15.0	55.0	29 05.9	03.7	222 21.5	18.5
03	78 09.8	210 51.1	38.1	294 16.1	54.6	44 08.7	03.6	237 23.7	18.6
04	93 12.3	225 50.4	39.1	309 17.2	54.2	59 11.5	03.5	252 25.9	18.7
05	108 14.7	240 49.8	40.0	324 18.3	53.8	74 14.3	03.4	267 28.1	18.8
06	123 17.2	255 49.1	S17 40.9	339 19.4	N15 53.4	89 17.1	N12 03.3	282 30.2	S 6 18.9
07	138 19.7	270 48.5	41.9	354 20.5	53.0	104 19.9	03.2	297 32.4	19.0
08	153 22.1	285 47.8	42.8	9 21.6	52.6	119 22.7	03.1	312 34.6	19.1
T 09	168 24.6	300 47.2	43.8	24 22.7	52.2	134 25.5	02.9	327 36.8	19.3
U 10	183 27.0	315 46.5	44.7	39 23.8	51.8	149 28.3	02.8	342 39.0	19.4
E 11	198 29.5	330 45.9	45.6	54 24.9	51.4	164 31.0	02.7	357 41.1	19.5
S 12	213 32.0	345 45.2	S17 46.6	69 26.0	N15 51.0	179 33.8	N12 02.6	12 43.3	S 6 19.6
D 13	228 34.4	0 44.6	47.5	84 27.1	50.6	194 36.6	02.5	27 45.5	19.7
A 14	243 36.9	15 43.9	48.4	99 28.3	50.2	209 39.4	02.4	42 47.7	19.8
Y 15	258 39.4	30 43.3	49.4	114 29.4	49.8	224 42.2	02.3	57 49.9	19.9
16	273 41.8	45 42.6	50.3	129 30.5	49.4	239 45.0	02.2	72 52.1	20.0
17	288 44.3	60 41.9	51.2	144 31.6	49.0	254 47.8	02.1	87 54.2	20.1
18	303 46.8	75 41.3	S17 52.1	159 32.7	N15 48.6	269 50.6	N12 02.0	102 56.4	S 6 20.2
19	318 49.2	90 40.6	53.1	174 33.8	48.2	284 53.4	01.8	117 58.6	20.4
20	333 51.7	105 40.0	54.0	189 34.9	47.8	299 56.2	01.7	133 00.8	20.5
21	348 54.2	120 39.3	54.9	204 36.0	47.4	314 59.0	01.6	148 03.0	20.6
22	3 56.6	135 38.7	55.9	219 37.1	47.0	330 01.8	01.5	163 05.1	20.7
23	18 59.1	150 38.0	56.8	234 38.2	46.6	345 04.5	01.4	178 07.3	20.8
26 00	34 01.5	165 37.4	S17 57.7	249 39.3	N15 46.2	0 07.3	N12 01.3	193 09.5	S 6 20.9
01	49 04.0	180 36.7	58.6	264 40.4	45.8	15 10.1	01.2	208 11.7	21.0
02	64 06.5	195 36.0	17 59.6	279 41.5	45.4	30 12.9	01.1	223 13.9	21.1
03	79 08.9	210 35.4	18 00.5	294 42.6	45.0	45 15.7	01.0	238 16.0	21.2
04	94 11.4	225 34.7	01.4	309 43.7	44.6	60 18.5	00.9	253 18.2	21.4
05	109 13.9	240 34.1	02.3	324 44.8	44.2	75 21.3	00.7	268 20.4	21.5
06	124 16.3	255 33.4	S18 03.2	339 46.0	N15 43.8	90 24.1	N12 00.6	283 22.6	S 6 21.6
W 07	139 18.8	270 32.7	04.2	354 47.1	43.4	105 26.9	00.5	298 24.8	21.7
E 08	154 21.3	285 32.1	05.1	9 48.2	43.0	120 29.7	00.4	313 27.0	21.8
D 09	169 23.7	300 31.4	06.0	24 49.3	42.6	135 32.5	00.3	328 29.1	21.9
N 10	184 26.2	315 30.7	06.9	39 50.4	42.1	150 35.3	00.2	343 31.3	22.0
E 11	199 28.6	330 30.1	07.8	54 51.5	41.7	165 38.0	00.1	358 33.5	22.1
S 12	214 31.1	345 29.4	S18 08.7	69 52.6	N15 41.3	180 40.8	N12 00.0	13 35.7	S 6 22.2
D 13	229 33.6	0 28.7	09.7	84 53.7	40.9	195 43.6	11 59.9	28 37.9	22.3
A 14	244 36.0	15 28.1	10.6	99 54.8	40.5	210 46.4	59.8	43 40.0	22.5
Y 15	259 38.5	30 27.4	11.5	114 56.0	40.1	225 49.2	59.6	58 42.2	22.6
16	274 41.0	45 26.7	12.4	129 57.1	39.7	240 52.0	59.5	73 44.4	22.7
17	289 43.4	60 26.1	13.3	144 58.2	39.3	255 54.8	59.4	88 46.6	22.8
18	304 45.9	75 25.4	S18 14.2	159 59.3	N15 38.9	270 57.6	N11 59.3	103 48.8	S 6 22.9
19	319 48.4	90 24.7	15.1	175 00.4	38.5	286 00.4	59.2	118 51.0	23.0
20	334 50.8	105 24.1	16.0	190 01.5	38.1	301 03.2	59.1	133 53.1	23.1
21	349 53.3	120 23.4	16.9	205 02.6	37.7	316 06.0	59.0	148 55.3	23.2
22	4 55.8	135 22.7	17.8	220 03.7	37.3	331 08.8	58.9	163 57.5	23.3
23	19 58.2	150 22.1	18.7	235 04.9	36.9	346 11.6	58.8	178 59.7	23.4
27 00	35 00.7	165 21.4	S18 19.6	250 06.0	N15 36.5	1 14.3	N11 58.7	194 01.9	S 6 23.6
01	50 03.1	180 20.7	20.6	265 07.1	36.1	16 17.1	58.5	209 04.0	23.7
02	65 05.6	195 20.0	21.5	280 08.2	35.7	31 19.9	58.4	224 06.2	23.8
03	80 08.1	210 19.4	22.4	295 09.3	35.3	46 22.7	58.3	239 08.4	23.9
04	95 10.5	225 18.7	23.3	310 10.4	34.9	61 25.5	58.2	254 10.6	24.0
05	110 13.0	240 18.0	24.2	325 11.6	34.5	76 28.3	58.1	269 12.8	24.1
06	125 15.5	255 17.4	S18 25.1	340 12.7	N15 34.1	91 31.1	N11 58.0	284 15.0	S 6 24.2
07	140 17.9	270 16.7	26.0	355 13.8	33.7	106 33.9	57.9	299 17.1	24.3
T 08	155 20.4	285 16.0	26.9	10 14.9	33.3	121 36.7	57.8	314 19.3	24.4
H 09	170 22.9	300 15.3	27.8	25 16.0	32.9	136 39.5	57.7	329 21.5	24.5
U 10	185 25.3	315 14.7	28.7	40 17.1	32.5	151 42.3	57.6	344 23.7	24.7
R 11	200 27.8	330 14.0	29.5	55 18.3	32.1	166 45.1	57.4	359 25.9	24.8
S 12	215 30.3	345 13.3	S18 30.4	70 19.4	N15 31.7	181 47.9	N11 57.3	14 28.0	S 6 24.9
D 13	230 32.7	0 12.6	31.3	85 20.5	31.3	196 50.6	57.2	29 30.2	25.0
A 14	245 35.2	15 11.9	32.2	100 21.6	30.9	211 53.4	57.1	44 32.4	25.1
Y 15	260 37.6	30 11.3	33.1	115 22.7	30.5	226 56.2	57.0	59 34.6	25.2
16	275 40.1	45 10.6	34.0	130 23.9	30.1	241 59.0	56.9	74 36.8	25.3
17	290 42.6	60 09.9	34.9	145 25.0	29.6	257 01.8	56.8	89 39.0	25.4
18	305 45.0	75 09.2	S18 35.8	160 26.1	N15 29.2	272 04.6	N11 56.7	104 41.1	S 6 25.5
19	320 47.5	90 08.5	36.7	175 27.2	28.8	287 07.4	56.6	119 43.3	25.6
20	335 50.0	105 07.9	37.6	190 28.3	28.4	302 10.2	56.5	134 45.5	25.8
21	350 52.4	120 07.2	38.5	205 29.5	28.0	317 13.0	56.3	149 47.7	25.9
22	5 54.9	135 06.5	39.3	220 30.6	27.6	332 15.8	56.2	164 49.9	26.0
23	20 57.4	150 05.8	40.2	235 31.7	27.2	347 18.6	56.1	179 52.0	26.1
	h m								
Mer. Pass.	21 40.3	*v* −0.7	*d* 0.9	*v* 1.1	*d* 0.4	*v* 2.8	*d* 0.1	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.3
Achernar	335 27.0	S57 10.5
Acrux	173 11.3	S63 09.8
Adhara	255 13.3	S28 59.1
Aldebaran	290 50.5	N16 32.0
Alioth	166 22.2	N55 53.6
Alkaid	153 00.3	N49 15.2
Al Na'ir	27 44.9	S46 54.2
Alnilam	275 47.3	S 1 11.6
Alphard	217 57.3	S 8 42.6
Alphecca	126 12.3	N26 40.6
Alpheratz	357 44.4	N29 09.6
Altair	62 09.4	N 8 54.2
Ankaa	353 16.4	S42 14.4
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.3
Atria	107 31.3	S69 03.0
Avior	234 18.5	S59 32.6
Bellatrix	278 33.0	N 6 21.6
Betelgeuse	271 02.4	N 7 24.6
Canopus	263 56.4	S52 41.9
Capella	280 35.9	N46 00.4
Deneb	49 32.3	N45 19.8
Denebola	182 35.1	N14 30.3
Diphda	348 56.7	S17 55.2
Dubhe	193 53.5	N61 41.0
Elnath	278 13.9	N28 37.0
Eltanin	90 47.0	N51 29.6
Enif	33 48.2	N 9 56.0
Fomalhaut	15 25.0	S29 33.5
Gacrux	172 02.8	S57 10.7
Gienah	175 53.8	S17 36.4
Hadar	148 50.3	S60 25.8
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.0	N74 06.4
Markab	13 39.3	N15 16.4
Menkar	314 16.0	N 4 08.3
Menkent	148 09.4	S36 25.6
Miaplacidus	221 40.2	S69 45.7
Mirfak	308 41.6	N49 54.2
Nunki	75 59.9	S26 16.8
Peacock	53 21.0	S56 41.9
Pollux	243 29.1	N27 59.7
Procyon	245 00.9	N 5 11.6
Rasalhague	96 07.8	N12 33.3
Regulus	207 44.9	N11 54.5
Rigel	281 12.9	S 8 11.2
Rigil Kent.	139 54.0	S60 53.0
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.4
Shaula	96 23.8	S37 06.7
Sirius	258 34.6	S16 43.8
Spica	158 32.8	S11 13.3
Suhail	222 53.4	S43 28.6
Vega	80 39.9	N38 48.0
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	131 35.8	12 58
Mars	215 37.8	7 21
Jupiter	326 05.8	0 00
Saturn	159 08.0	11 06

2011 OCTOBER 25, 26, 27 (TUES., WED., THURS.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
25 00	183 57.5	S11 53.9	210 15.0	8.2	S 6 28.9	14.0	61.0
01	198 57.6	54.8	224 42.2	8.1	6 42.9	13.9	61.1
02	213 57.7	55.7	239 09.3	8.1	6 56.8	13.9	61.1
03	228 57.7	. . 56.5	253 36.4	8.0	7 10.7	13.8	61.1
04	243 57.8	57.4	268 03.4	8.0	7 24.5	13.8	61.1
05	258 57.9	58.3	282 30.4	7.9	7 38.3	13.8	61.1
06	273 58.0	S11 59.1	296 57.3	7.8	S 7 52.1	13.7	61.1
07	288 58.0	12 00.0	311 24.1	7.8	8 05.8	13.7	61.2
T 08	303 58.1	00.9	325 50.9	7.7	8 19.5	13.6	61.2
U 09	318 58.2	. . 01.7	340 17.6	7.7	8 33.1	13.6	61.2
E 10	333 58.3	02.6	354 44.3	7.6	8 46.7	13.5	61.2
S 11	348 58.3	03.5	9 10.9	7.5	9 00.2	13.5	61.2
D 12	3 58.4	S12 04.3	23 37.4	7.4	S 9 13.7	13.4	61.2
A 13	18 58.5	05.2	38 03.8	7.4	9 27.1	13.4	61.3
Y 14	33 58.5	06.0	52 30.2	7.4	9 40.5	13.3	61.3
15	48 58.6	. . 06.9	66 56.6	7.2	9 53.8	13.3	61.3
16	63 58.7	07.8	81 22.8	7.2	10 07.1	13.2	61.3
17	78 58.8	08.6	95 49.0	7.2	10 20.3	13.1	61.3
18	93 58.8	S12 09.5	110 15.2	7.0	S10 33.4	13.1	61.3
19	108 58.9	10.3	124 41.2	7.0	10 46.5	13.0	61.3
20	123 59.0	11.2	139 07.2	7.0	10 59.5	12.9	61.3
21	138 59.0	. . 12.1	153 33.2	6.9	11 12.4	12.9	61.3
22	153 59.1	12.9	167 59.1	6.8	11 25.3	12.8	61.4
23	168 59.2	13.8	182 24.9	6.7	11 38.1	12.7	61.4
26 00	183 59.2	S12 14.6	196 50.6	6.7	S11 50.8	12.6	61.4
01	198 59.3	15.5	211 16.3	6.6	12 03.4	12.6	61.4
02	213 59.4	16.4	225 41.9	6.5	12 16.0	12.5	61.4
03	228 59.5	. . 17.2	240 07.4	6.5	12 28.5	12.4	61.4
04	243 59.5	18.1	254 32.9	6.4	12 40.9	12.3	61.4
05	258 59.6	18.9	268 58.3	6.3	12 53.2	12.3	61.4
06	273 59.7	S12 19.8	283 23.6	6.3	S13 05.5	12.1	61.4
W 07	288 59.7	20.6	297 48.9	6.2	13 17.6	12.1	61.4
E 08	303 59.8	21.5	312 14.1	6.1	13 29.7	11.9	61.4
D 09	318 59.9	. . 22.4	326 39.2	6.1	13 41.6	11.9	61.4
N 10	333 59.9	23.2	341 04.3	6.0	13 53.5	11.8	61.4
E 11	349 00.0	24.1	355 29.3	5.9	14 05.3	11.7	61.4
S 12	4 00.0	S12 24.9	9 54.2	5.9	S14 17.0	11.6	61.4
D 13	19 00.1	25.8	24 19.1	5.8	14 28.6	11.5	61.4
A 14	34 00.2	26.6	38 43.9	5.8	14 40.1	11.3	61.4
Y 15	49 00.2	. . 27.5	53 08.7	5.6	14 51.4	11.3	61.4
16	64 00.3	28.3	67 33.3	5.7	15 02.7	11.2	61.4
17	79 00.4	29.2	81 58.0	5.5	15 13.9	11.1	61.4
18	94 00.4	S12 30.0	96 22.5	5.5	S15 25.0	10.9	61.4
19	109 00.5	30.9	110 47.0	5.4	15 35.9	10.9	61.4
20	124 00.6	31.7	125 11.4	5.4	15 46.8	10.7	61.4
21	139 00.6	. . 32.6	139 35.8	5.3	15 57.5	10.6	61.4
22	154 00.7	33.4	154 00.1	5.2	16 08.1	10.5	61.4
23	169 00.7	34.3	168 24.3	5.2	16 18.6	10.4	61.4
27 00	184 00.8	S12 35.1	182 48.5	5.1	S16 29.0	10.3	61.4
01	199 00.9	36.0	197 12.6	5.1	16 39.3	10.2	61.4
02	214 00.9	36.8	211 36.7	5.0	16 49.5	10.0	61.4
03	229 01.0	. . 37.7	226 00.7	4.9	16 59.5	9.9	61.3
04	244 01.0	38.5	240 24.6	4.9	17 09.4	9.8	61.3
05	259 01.1	39.4	254 48.5	4.9	17 19.2	9.6	61.3
06	274 01.2	S12 40.2	269 12.4	4.7	S17 28.8	9.6	61.3
T 07	289 01.2	41.1	283 36.1	4.8	17 38.4	9.4	61.3
H 08	304 01.3	41.9	297 59.9	4.7	17 47.8	9.2	61.3
U 09	319 01.3	. . 42.8	312 23.6	4.6	17 57.0	9.2	61.3
R 10	334 01.4	43.6	326 47.2	4.5	18 06.2	9.0	61.3
S 11	349 01.5	44.5	341 10.7	4.6	18 15.2	8.8	61.3
D 12	4 01.5	S12 45.3	355 34.3	4.4	S18 24.0	8.7	61.2
A 13	19 01.6	46.2	9 57.7	4.5	18 32.7	8.6	61.2
Y 14	34 01.6	47.0	24 21.2	4.4	18 41.3	8.5	61.2
15	49 01.7	. . 47.9	38 44.6	4.3	18 49.8	8.3	61.2
16	64 01.7	48.7	53 07.9	4.3	18 58.1	8.2	61.2
17	79 01.8	49.6	67 31.2	4.3	19 06.3	8.0	61.2
18	94 01.9	S12 50.4	81 54.5	4.2	S19 14.3	7.9	61.2
19	109 01.9	51.2	96 17.7	4.1	19 22.2	7.7	61.1
20	124 02.0	52.1	110 40.8	4.2	19 29.9	7.6	61.1
21	139 02.0	. . 52.9	125 04.0	4.1	19 37.5	7.4	61.1
22	154 02.1	53.8	139 27.1	4.1	19 44.9	7.3	61.1
23	169 02.1	54.6	153 50.2	4.0	S19 52.2	7.2	61.1
	SD 16.1	d 0.9	SD	16.7		16.7	16.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 25	Moonrise 26	Moonrise 27	Moonrise 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 40	07 00	08 19	05 55	08 28	▬	▬
N 70	05 39	06 51	08 00	05 42	07 59	10 38	▬
68	05 38	06 43	07 45	05 32	07 37	09 52	12 22
66	05 37	06 37	07 32	05 24	07 21	09 22	11 20
64	05 35	06 31	07 22	05 17	07 07	08 59	10 46
62	05 34	06 26	07 13	05 11	06 56	08 41	10 21
60	05 33	06 22	07 06	05 06	06 46	08 27	10 01
N 58	05 32	06 18	06 59	05 01	06 38	08 14	09 45
56	05 31	06 15	06 53	04 57	06 30	08 03	09 31
54	05 30	06 11	06 48	04 53	06 24	07 54	09 19
52	05 29	06 08	06 43	04 50	06 18	07 46	09 09
50	05 28	06 06	06 39	04 47	06 13	07 38	08 59
45	05 25	05 59	06 30	04 41	06 01	07 22	08 40
N 40	05 22	05 54	06 22	04 36	05 52	07 09	08 24
35	05 19	05 49	06 15	04 31	05 44	06 58	08 10
30	05 17	05 45	06 09	04 27	05 37	06 48	07 59
20	05 10	05 36	05 59	04 20	05 25	06 32	07 39
N 10	05 03	05 28	05 49	04 14	05 15	06 17	07 21
0	04 55	05 19	05 41	04 09	05 05	06 04	07 05
S 10	04 45	05 10	05 32	04 03	04 55	05 51	06 49
20	04 33	04 59	05 22	03 58	04 45	05 37	06 32
30	04 17	04 46	05 11	03 51	04 34	05 21	06 13
35	04 07	04 38	05 05	03 47	04 27	05 12	06 02
40	03 54	04 29	04 57	03 43	04 20	05 01	05 49
45	03 39	04 17	04 49	03 38	04 11	04 49	05 34
S 50	03 19	04 03	04 38	03 33	04 01	04 34	05 15
52	03 09	03 56	04 33	03 30	03 56	04 27	05 06
54	02 58	03 49	04 28	03 27	03 51	04 20	04 57
56	02 45	03 40	04 22	03 24	03 45	04 11	04 46
58	02 30	03 30	04 15	03 21	03 39	04 02	04 33
S 60	02 11	03 19	04 08	03 17	03 31	03 51	04 19

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 25	Moonset 26	Moonset 27	Moonset 28
°	h m	h m	h m	h m	h m	h m	h m
N 72	15 07	16 26	17 46	14 20	13 47	▬	▬
N 70	15 27	16 35	17 47	14 36	14 18	13 44	▬
68	15 42	16 43	17 49	14 48	14 41	14 31	14 10
66	15 54	16 50	17 50	14 58	14 59	15 02	15 12
64	16 05	16 56	17 51	15 07	15 14	15 26	15 48
62	16 14	17 01	17 52	15 14	15 26	15 44	16 13
60	16 21	17 05	17 54	15 21	15 37	15 59	16 33
N 58	16 28	17 09	17 55	15 26	15 46	16 13	16 50
56	16 34	17 12	17 56	15 31	15 54	16 24	17 04
54	16 39	17 16	17 57	15 36	16 02	16 34	17 16
52	16 44	17 19	17 58	15 40	16 08	16 43	17 27
50	16 48	17 22	17 59	15 44	16 14	16 51	17 36
45	16 58	17 28	18 02	15 52	16 27	17 08	17 57
N 40	17 06	17 33	18 05	15 59	16 38	17 22	18 13
35	17 12	17 38	18 08	16 05	16 47	17 34	18 27
30	17 19	17 43	18 11	16 10	16 55	17 44	18 39
20	17 29	17 52	18 18	16 19	17 09	18 02	19 00
N 10	17 38	18 00	18 25	16 28	17 21	18 18	19 18
0	17 47	18 09	18 33	16 35	17 33	18 33	19 35
S 10	17 56	18 18	18 43	16 43	17 44	18 48	19 52
20	18 06	18 29	18 56	16 51	17 57	19 04	20 10
30	18 17	18 42	19 12	17 00	18 11	19 22	20 31
35	18 24	18 50	19 22	17 05	18 19	19 32	20 43
40	18 31	19 00	19 35	17 12	18 28	19 45	20 57
45	18 40	19 12	19 50	17 19	18 40	19 59	21 13
S 50	18 51	19 26	20 10	17 27	18 53	20 17	21 34
52	18 56	19 33	20 20	17 31	18 59	20 25	21 44
54	19 01	19 41	20 32	17 36	19 06	20 34	21 55
56	19 07	19 50	20 45	17 41	19 14	20 45	22 07
58	19 14	20 00	21 01	17 46	19 23	20 57	22 22
S 60	19 22	20 11	21 21	17 52	19 33	21 11	22 39

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
25	15 50	15 53	11 44	10 22	22 50	28	3
26	15 57	16 00	11 44	11 19	23 48	29	0
27	16 03	16 06	11 44	12 18	24 49	01	1

UT	ARIES	VENUS −3.8		MARS +1.1		JUPITER −2.9		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
28 00	35 59.8	165 05.1	S18 41.1	250 32.8	N15 26.8	2 21.4	N11 56.0	194 54.2	S 6 26.2
01	51 02.3	180 04.4	42.0	265 33.9	26.4	17 24.2	55.9	209 56.4	26.3
02	66 04.7	195 03.8	42.9	280 35.1	26.0	32 27.0	55.8	224 58.6	26.4
03	81 07.2	210 03.1 . .	43.8	295 36.2 . .	25.6	47 29.7 . .	55.7	240 00.8 . .	26.5
04	96 09.7	225 02.4	44.6	310 37.3	25.2	62 32.5	55.6	255 03.0	26.6
05	111 12.1	240 01.7	45.5	325 38.4	24.8	77 35.3	55.5	270 05.1	26.7
06	126 14.6	255 01.0	S18 46.4	340 39.6	N15 24.4	92 38.1	N11 55.4	285 07.3	S 6 26.8
07	141 17.1	270 00.3	47.3	355 40.7	24.0	107 40.9	55.2	300 09.5	27.0
08	156 19.5	284 59.6	48.2	10 41.8	23.6	122 43.7	55.1	315 11.7	27.1
F 09	171 22.0	299 58.9 . .	49.0	25 42.9 . .	23.2	137 46.5 . .	55.0	330 13.9 . .	27.2
R 10	186 24.5	314 58.3	49.9	40 44.1	22.8	152 49.3	54.9	345 16.1	27.3
I 11	201 26.9	329 57.6	50.8	55 45.2	22.4	167 52.1	54.8	0 18.2	27.4
D 12	216 29.4	344 56.9	S18 51.7	70 46.3	N15 22.0	182 54.9	N11 54.7	15 20.4	S 6 27.5
A 13	231 31.9	359 56.2	52.5	85 47.4	21.6	197 57.7	54.6	30 22.6	27.6
Y 14	246 34.3	14 55.5	53.4	100 48.6	21.2	213 00.5	54.5	45 24.8	27.7
15	261 36.8	29 54.8 . .	54.3	115 49.7 . .	20.8	228 03.3 . .	54.4	60 27.0 . .	27.8
16	276 39.2	44 54.1	55.1	130 50.8	20.4	243 06.1	54.3	75 29.1	27.9
17	291 41.7	59 53.4	56.0	145 52.0	19.9	258 08.8	54.1	90 31.3	28.1
18	306 44.2	74 52.7	S18 56.9	160 53.1	N15 19.5	273 11.6	N11 54.0	105 33.5	S 6 28.2
19	321 46.6	89 52.0	57.8	175 54.2	19.1	288 14.4	53.9	120 35.7	28.3
20	336 49.1	104 51.3	58.6	190 55.3	18.7	303 17.2	53.8	135 37.9	28.4
21	351 51.6	119 50.6	18 59.5	205 56.5 . .	18.3	318 20.0 . .	53.7	150 40.1 . .	28.5
22	6 54.0	134 49.9	19 00.3	220 57.6	17.9	333 22.8	53.6	165 42.2	28.6
23	21 56.5	149 49.2	01.2	235 58.7	17.5	348 25.6	53.5	180 44.4	28.7
29 00	36 59.0	164 48.5	S19 02.1	250 59.9	N15 17.1	3 28.4	N11 53.4	195 46.6	S 6 28.8
01	52 01.4	179 47.8	02.9	266 01.0	16.7	18 31.2	53.3	210 48.8	28.9
02	67 03.9	194 47.2	03.8	281 02.1	16.3	33 34.0	53.2	225 51.0	29.0
03	82 06.4	209 46.5 . .	04.7	296 03.3 . .	15.9	48 36.8 . .	53.0	240 53.2 . .	29.1
04	97 08.8	224 45.8	05.5	311 04.4	15.5	63 39.6	52.9	255 55.3	29.3
05	112 11.3	239 45.1	06.4	326 05.5	15.1	78 42.4	52.8	270 57.5	29.4
06	127 13.7	254 44.4	S19 07.2	341 06.7	N15 14.7	93 45.1	N11 52.7	285 59.7	S 6 29.5
07	142 16.2	269 43.7	08.1	356 07.8	14.3	108 47.9	52.6	301 01.9	29.6
S 08	157 18.7	284 43.0	09.0	11 08.9	13.9	123 50.7	52.5	316 04.1	29.7
A 09	172 21.1	299 42.3 . .	09.8	26 10.1 . .	13.5	138 53.5 . .	52.4	331 06.3 . .	29.8
T 10	187 23.6	314 41.5	10.7	41 11.2	13.1	153 56.3	52.3	346 08.4	29.9
U 11	202 26.1	329 40.8	11.5	56 12.3	12.7	168 59.1	52.2	1 10.6	30.0
R 12	217 28.5	344 40.1	S19 12.4	71 13.5	N15 12.3	184 01.9	N11 52.1	16 12.8	S 6 30.1
D 13	232 31.0	359 39.4	13.2	86 14.6	11.9	199 04.7	51.9	31 15.0	30.2
A 14	247 33.5	14 38.7	14.1	101 15.7	11.4	214 07.5	51.8	46 17.2	30.3
Y 15	262 35.9	29 38.0 . .	14.9	116 16.9 . .	11.0	229 10.3 . .	51.7	61 19.4 . .	30.5
16	277 38.4	44 37.3	15.8	131 18.0	10.6	244 13.1	51.6	76 21.5	30.6
17	292 40.9	59 36.6	16.6	146 19.1	10.2	259 15.9	51.5	91 23.7	30.7
18	307 43.3	74 35.9	S19 17.5	161 20.3	N15 09.8	274 18.7	N11 51.4	106 25.9	S 6 30.8
19	322 45.8	89 35.2	18.3	176 21.4	09.4	289 21.5	51.3	121 28.1	30.9
20	337 48.2	104 34.5	19.2	191 22.5	09.0	304 24.2	51.2	136 30.3	31.0
21	352 50.7	119 33.8 . .	20.0	206 23.7 . .	08.6	319 27.0 . .	51.1	151 32.5 . .	31.1
22	7 53.2	134 33.1	20.9	221 24.8	08.2	334 29.8	51.0	166 34.6	31.2
23	22 55.6	149 32.4	21.7	236 26.0	07.8	349 32.6	50.8	181 36.8	31.3
30 00	37 58.1	164 31.7	S19 22.5	251 27.1	N15 07.4	4 35.4	N11 50.7	196 39.0	S 6 31.4
01	53 00.6	179 30.9	23.4	266 28.2	07.0	19 38.2	50.6	211 41.2	31.5
02	68 03.0	194 30.2	24.2	281 29.4	06.6	34 41.0	50.5	226 43.4	31.6
03	83 05.5	209 29.5 . .	25.1	296 30.5 . .	06.2	49 43.8 . .	50.4	241 45.6 . .	31.8
04	98 08.0	224 28.8	25.9	311 31.6	05.8	64 46.6	50.3	256 47.7	31.9
05	113 10.4	239 28.1	26.7	326 32.8	05.4	79 49.4	50.2	271 49.9	32.0
06	128 12.9	254 27.4	S19 27.6	341 33.9	N15 05.0	94 52.2	N11 50.1	286 52.1	S 6 32.1
07	143 15.4	269 26.7	28.4	356 35.1	04.6	109 55.0	50.0	301 54.3	32.2
08	158 17.8	284 26.0	29.2	11 36.2	04.2	124 57.8	49.9	316 56.5	32.3
S 09	173 20.3	299 25.2 . .	30.1	26 37.3 . .	03.8	140 00.5 . .	49.7	331 58.7 . .	32.4
U 10	188 22.7	314 24.5	30.9	41 38.5	03.3	155 03.3	49.6	347 00.8	32.5
N 11	203 25.2	329 23.8	31.7	56 39.6	02.9	170 06.1	49.5	2 03.0	32.6
D 12	218 27.7	344 23.1	S19 32.6	71 40.8	N15 02.5	185 08.9	N11 49.4	17 05.2	S 6 32.7
A 13	233 30.1	359 22.4	33.4	86 41.9	02.1	200 11.7	49.3	32 07.4	32.8
Y 14	248 32.6	14 21.7	34.2	101 43.1	01.7	215 14.5	49.2	47 09.6	33.0
15	263 35.1	29 20.9 . .	35.1	116 44.2 . .	01.3	230 17.3 . .	49.1	62 11.8 . .	33.1
16	278 37.5	44 20.2	35.9	131 45.3	00.9	245 20.1	49.0	77 13.9	33.2
17	293 40.0	59 19.5	36.7	146 46.5	00.5	260 22.9	48.9	92 16.1	33.3
18	308 42.5	74 18.8	S19 37.5	161 47.6	N15 00.1	275 25.7	N11 48.8	107 18.3	S 6 33.4
19	323 44.9	89 18.1	38.4	176 48.8	14 59.7	290 28.5	48.7	122 20.5	33.5
20	338 47.4	104 17.4	39.2	191 49.9	59.3	305 31.3	48.5	137 22.7	33.6
21	353 49.8	119 16.6 . .	40.0	206 51.1 . .	58.9	320 34.1 . .	48.4	152 24.9 . .	33.7
22	8 52.3	134 15.9	40.8	221 52.2	58.5	335 36.8	48.3	167 27.0	33.8
23	23 54.8	149 15.2	41.7	236 53.4	58.1	350 39.6	48.2	182 29.2	33.9
Mer. Pass.	h m 21 28.5	v −0.7	d 0.9	v 1.1	d 0.4	v 2.8	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.3
Achernar	335 27.0	S57 10.5
Acrux	173 11.3	S63 09.8
Adhara	255 13.3	S28 59.1
Aldebaran	290 50.4	N16 32.0
Alioth	166 22.2	N55 53.6
Alkaid	153 00.3	N49 15.2
Al Na'ir	27 45.0	S46 54.2
Alnilam	275 47.3	S 1 11.6
Alphard	217 57.3	S 8 42.6
Alphecca	126 12.3	N26 40.6
Alpheratz	357 44.4	N29 09.6
Altair	62 09.4	N 8 54.2
Ankaa	353 16.4	S42 14.4
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.3
Atria	107 31.3	S69 03.0
Avior	234 18.5	S59 32.6
Bellatrix	278 33.0	N 6 21.6
Betelgeuse	271 02.4	N 7 24.5
Canopus	263 56.4	S52 41.9
Capella	280 35.8	N46 00.4
Deneb	49 32.3	N45 19.8
Denebola	182 35.1	N14 30.3
Diphda	348 56.7	S17 55.2
Dubhe	193 53.5	N61 40.9
Elnath	278 13.8	N28 37.0
Eltanin	90 47.0	N51 29.6
Enif	33 48.2	N 9 56.0
Fomalhaut	15 25.0	S29 33.5
Gacrux	172 02.8	S57 10.7
Gienah	175 53.8	S17 36.4
Hadar	148 50.3	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.1	N74 06.4
Markab	13 39.3	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.4	S36 25.6
Miaplacidus	221 40.2	S69 45.7
Mirfak	308 41.6	N49 54.2
Nunki	75 59.9	S26 16.8
Peacock	53 21.1	S56 41.9
Pollux	243 29.1	N27 59.7
Procyon	245 00.9	N 5 11.6
Rasalhague	96 07.8	N12 33.3
Regulus	207 44.9	N11 54.5
Rigel	281 12.9	S 8 11.2
Rigil Kent.	139 54.0	S60 53.0
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.4
Shaula	96 23.8	S37 06.7
Sirius	258 34.6	S16 43.9
Spica	158 32.8	S11 13.3
Suhail	222 53.4	S43 28.6
Vega	80 40.0	N38 48.0
Zuben'ubi	137 07.1	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	127 49.6	13 01
Mars	214 00.9	7 15
Jupiter	326 29.4	23 42
Saturn	158 47.7	10 55

UT	SUN			MOON					
	GHA		Dec	GHA		v	Dec		d	HP
d h	°	′	° ′	°	′	′	°	′	′	′
28 00	184	02.2	S12 55.5	168	13.2	4.0	S19	59.4	6.9	61.0
01	199	02.2	56.3	182	36.2	4.0	20	06.3	6.9	61.0
02	214	02.3	57.1	196	59.2	3.9	20	13.2	6.7	61.0
03	229	02.3	. . 58.0	211	22.1	3.9	20	19.9	6.5	61.0
04	244	02.4	58.8	225	45.0	3.9	20	26.4	6.4	61.0
05	259	02.4	12 59.7	240	07.9	3.9	20	32.8	6.2	60.9
06	274	02.5	S13 00.5	254	30.8	3.9	S20	39.0	6.1	60.9
07	289	02.5	01.3	268	53.7	3.8	20	45.1	5.9	60.9
08	304	02.6	02.2	283	16.5	3.8	20	51.0	5.7	60.9
F 09	319	02.6	. . 03.0	297	39.3	3.8	20	56.7	5.6	60.8
R 10	334	02.7	03.9	312	02.1	3.8	21	02.3	5.5	60.8
I 11	349	02.7	04.7	326	24.9	3.7	21	07.8	5.3	60.8
D 12	4	02.8	S13 05.5	340	47.6	3.8	S21	13.1	5.1	60.8
A 13	19	02.8	06.4	355	10.4	3.8	21	18.2	4.9	60.7
Y 14	34	02.9	07.2	9	33.2	3.7	21	23.1	4.8	60.7
15	49	02.9	. . 08.0	23	55.9	3.7	21	27.9	4.7	60.7
16	64	03.0	08.9	38	18.6	3.8	21	32.6	4.4	60.7
17	79	03.0	09.7	52	41.4	3.7	21	37.0	4.4	60.6
18	94	03.1	S13 10.6	67	04.1	3.7	S21	41.4	4.1	60.6
19	109	03.1	11.4	81	26.8	3.8	21	45.5	4.0	60.6
20	124	03.2	12.2	95	49.6	3.7	21	49.5	3.8	60.5
21	139	03.2	. . 13.1	110	12.3	3.8	21	53.3	3.7	60.5
22	154	03.3	13.9	124	35.1	3.7	21	57.0	3.5	60.5
23	169	03.3	14.7	138	57.8	3.8	22	00.5	3.3	60.5
29 00	184	03.4	S13 15.6	153	20.6	3.8	S22	03.8	3.2	60.4
01	199	03.4	16.4	167	43.4	3.8	22	07.0	3.0	60.4
02	214	03.5	17.2	182	06.2	3.8	22	10.0	2.9	60.4
03	229	03.5	. . 18.1	196	29.0	3.8	22	12.9	2.6	60.3
04	244	03.5	18.9	210	51.8	3.9	22	15.5	2.6	60.3
05	259	03.6	19.7	225	14.7	3.8	22	18.1	2.3	60.3
06	274	03.6	S13 20.6	239	37.5	3.9	S22	20.4	2.2	60.2
07	289	03.7	21.4	254	00.4	4.0	22	22.6	2.0	60.2
S 08	304	03.7	22.2	268	23.4	3.9	22	24.6	1.9	60.2
A 09	319	03.8	. . 23.1	282	46.3	4.0	22	26.5	1.7	60.1
T 10	334	03.8	23.9	297	09.3	4.0	22	28.2	1.6	60.1
U 11	349	03.9	24.7	311	32.3	4.1	22	29.8	1.3	60.1
R 12	4	03.9	S13 25.5	325	55.4	4.1	S22	31.1	1.3	60.0
D 13	19	03.9	26.4	340	18.5	4.1	22	32.4	1.0	60.0
A 14	34	04.0	27.2	354	41.6	4.1	22	33.4	0.9	60.0
Y 15	49	04.0	. . 28.0	9	04.7	4.3	22	34.3	0.8	59.9
16	64	04.1	28.9	23	28.0	4.2	22	35.1	0.5	59.9
17	79	04.1	29.7	37	51.2	4.3	22	35.6	0.5	59.9
18	94	04.1	S13 30.5	52	14.5	4.3	S22	36.1	0.2	59.8
19	109	04.2	31.3	66	37.8	4.4	22	36.3	0.1	59.8
20	124	04.2	32.2	81	01.2	4.5	22	36.4	0.0	59.7
21	139	04.3	. . 33.0	95	24.7	4.5	22	36.4	0.3	59.7
22	154	04.3	33.8	109	48.2	4.5	22	36.1	0.3	59.7
23	169	04.3	34.6	124	11.7	4.6	22	35.8	0.5	59.6
30 00	184	04.4	S13 35.5	138	35.3	4.7	S22	35.3	0.7	59.6
01	199	04.4	36.3	152	59.0	4.7	22	34.6	0.9	59.6
02	214	04.4	37.1	167	22.7	4.8	22	33.7	1.0	59.5
03	229	04.5	. . 37.9	181	46.5	4.8	22	32.7	1.1	59.5
04	244	04.5	38.8	196	10.3	4.9	22	31.6	1.3	59.4
05	259	04.6	39.6	210	34.2	5.0	22	30.3	1.4	59.4
06	274	04.6	S13 40.4	224	58.2	5.1	S22	28.9	1.6	59.4
07	289	04.6	41.2	239	22.3	5.1	22	27.3	1.8	59.3
08	304	04.7	42.0	253	46.4	5.2	22	25.5	1.9	59.3
S 09	319	04.7	. . 42.9	268	10.6	5.2	22	23.6	2.0	59.2
U 10	334	04.7	43.7	282	34.8	5.3	22	21.6	2.2	59.2
N 11	349	04.8	44.5	296	59.1	5.4	22	19.4	2.3	59.2
D 12	4	04.8	S13 45.3	311	23.5	5.5	S22	17.1	2.5	59.1
A 13	19	04.8	46.2	325	48.0	5.6	22	14.6	2.6	59.1
Y 14	34	04.9	47.0	340	12.6	5.6	22	12.0	2.8	59.0
15	49	04.9	. . 47.8	354	37.2	5.7	22	09.2	2.9	59.0
16	64	04.9	48.6	9	01.9	5.8	22	06.3	3.0	59.0
17	79	05.0	49.4	23	26.7	5.9	22	03.3	3.2	58.9
18	94	05.0	S13 50.2	37	51.6	5.9	S22	00.1	3.3	58.9
19	109	05.0	51.1	52	16.5	6.0	21	56.8	3.5	58.8
20	124	05.1	51.9	66	41.5	6.2	21	53.3	3.5	58.8
21	139	05.1	. . 52.7	81	06.7	6.2	21	49.8	3.8	58.8
22	154	05.1	53.5	95	31.9	6.3	21	46.0	3.8	58.7
23	169	05.2	54.3	109	57.2	6.4	S21	42.2	4.0	58.7
	SD	16.1	d 0.8	SD		16.6		16.4		16.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 28	Moonrise 29	Moonrise 30	Moonrise 31
°	h m	h m	h m	h m	h m	h m	h m
N 72	05 53	07 14	08 36				
N 70	05 50	07 03	08 14				
68	05 48	06 54	07 57	12 22			14 48
66	05 45	06 46	07 43	11 20	12 59	13 49	14 05
64	05 43	06 40	07 31	10 46	12 13	13 08	13 36
62	05 42	06 34	07 22	10 21	11 43	12 39	13 14
60	05 40	06 29	07 13	10 01	11 20	12 18	12 56
N 58	05 38	06 25	07 06	09 45	11 02	12 00	12 41
56	05 37	06 21	07 00	09 31	10 46	11 45	12 28
54	05 35	06 17	06 54	09 19	10 33	11 32	12 16
52	05 34	06 13	06 49	09 09	10 22	11 21	12 07
50	05 32	06 10	06 44	08 59	10 11	11 11	11 58
45	05 29	06 03	06 34	08 40	09 50	10 50	11 39
N 40	05 25	05 57	06 25	08 24	09 32	10 33	11 23
35	05 22	05 52	06 18	08 10	09 18	10 18	11 10
30	05 19	05 47	06 11	07 59	09 05	10 06	10 59
20	05 11	05 37	06 00	07 39	08 44	09 44	10 39
N 10	05 03	05 28	05 50	07 21	08 25	09 26	10 22
0	04 54	05 19	05 40	07 05	08 07	09 08	10 06
S 10	04 44	05 09	05 31	06 49	07 50	08 51	09 50
20	04 31	04 57	05 20	06 32	07 32	08 32	09 33
30	04 14	04 43	05 08	06 13	07 10	08 11	09 13
35	04 03	04 35	05 01	06 02	06 58	07 59	09 02
40	03 50	04 25	04 53	05 49	06 43	07 44	08 48
45	03 33	04 12	04 44	05 34	06 27	07 27	08 33
S 50	03 12	03 57	04 33	05 15	06 06	07 06	08 13
52	03 02	03 50	04 27	05 06	05 56	06 56	08 04
54	02 50	03 42	04 21	04 57	05 45	06 45	07 54
56	02 35	03 32	04 15	04 46	05 32	06 32	07 42
58	02 18	03 22	04 08	04 33	05 17	06 17	07 29
S 60	01 57	03 09	03 59	04 19	05 00	05 59	07 13

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 28	Moonset 29	Moonset 30	Moonset 31
°	h m	h m	h m	h m	h m	h m	h m
N 72	14 50	16 12	17 33				
N 70	15 12	16 23	17 36				
68	15 29	16 32	17 38	14 10			18 00
66	15 43	16 40	17 41	15 12	15 44	17 00	18 42
64	15 55	16 47	17 43	15 48	16 30	17 41	19 11
62	16 05	16 52	17 45	16 13	17 00	18 09	19 33
60	16 13	16 57	17 46	16 33	17 23	18 31	19 50
N 58	16 20	17 02	17 48	16 50	17 41	18 48	20 05
56	16 27	17 06	17 50	17 04	17 57	19 03	20 17
54	16 33	17 10	17 51	17 16	18 10	19 16	20 28
52	16 38	17 13	17 53	17 27	18 22	19 27	20 38
50	16 43	17 16	17 54	17 36	18 32	19 37	20 46
45	16 53	17 24	17 58	17 57	18 54	19 57	21 05
N 40	17 02	17 30	18 02	18 13	19 11	20 14	21 19
35	17 09	17 35	18 05	18 27	19 26	20 28	21 32
30	17 16	17 40	18 09	18 39	19 39	20 40	21 43
20	17 27	17 50	18 16	19 00	20 00	21 01	22 01
N 10	17 38	17 59	18 24	19 18	20 19	21 19	22 17
0	17 47	18 08	18 33	19 35	20 37	21 36	22 32
S 10	17 57	18 19	18 44	19 52	20 54	21 53	22 47
20	18 07	18 30	18 57	20 10	21 13	22 11	23 03
30	18 20	18 45	19 14	20 31	21 35	22 32	23 21
35	18 27	18 53	19 25	20 43	21 47	22 44	23 32
40	18 35	19 04	19 39	20 57	22 02	22 57	23 44
45	18 44	19 16	19 55	21 13	22 19	23 13	23 58
S 50	18 56	19 32	20 17	21 34	22 40	23 33	24 15
52	19 01	19 39	20 28	21 44	22 50	23 43	24 23
54	19 07	19 47	20 40	21 55	23 02	23 53	24 32
56	19 14	19 57	20 55	22 07	23 15	24 05	00 05
58	19 21	20 08	21 12	22 22	23 30	24 19	00 19
S 60	19 30	20 21	21 35	22 39	23 48	24 35	00 35

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
28	16 09	16 11	11 44	13 20	00 49	02	4
29	16 13	16 15	11 44	14 22	01 51	03	10
30	16 17	16 19	11 44	15 22	02 53	04	18

UT	ARIES	VENUS −3.8		MARS +1.1		JUPITER −2.9		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
31 00	38 57.2	164 14.5	S19 42.5	251 54.5	N14 57.7	5 42.4	N11 48.1	197 31.4	S 6 34.0
01	53 59.7	179 13.7	43.3	266 55.7	57.3	20 45.2	48.0	212 33.6	34.1
02	69 02.2	194 13.0	44.1	281 56.8	56.9	35 48.0	47.9	227 35.8	34.3
03	84 04.6	209 12.3	44.9	296 57.9	56.5	50 50.8	47.8	242 38.0	34.4
04	99 07.1	224 11.6	45.7	311 59.1	56.0	65 53.6	47.7	257 40.2	34.5
05	114 09.6	239 10.8	46.6	327 00.2	55.6	80 56.4	47.6	272 42.3	34.6
06	129 12.0	254 10.1	S19 47.4	342 01.4	N14 55.2	95 59.2	N11 47.5	287 44.5	S 6 34.7
07	144 14.5	269 09.4	48.2	357 02.5	54.8	111 02.0	47.3	302 46.7	34.8
08	159 17.0	284 08.7	49.0	12 03.7	54.4	126 04.8	47.2	317 48.9	34.9
M 09	174 19.4	299 07.9	49.8	27 04.8	54.0	141 07.6	47.1	332 51.1	35.0
O 10	189 21.9	314 07.2	50.6	42 06.0	53.6	156 10.3	47.0	347 53.3	35.1
N 11	204 24.3	329 06.5	51.4	57 07.1	53.2	171 13.1	46.9	2 55.4	35.2
D 12	219 26.8	344 05.8	S19 52.2	72 08.3	N14 52.8	186 15.9	N11 46.8	17 57.6	S 6 35.3
A 13	234 29.3	359 05.0	53.1	87 09.4	52.4	201 18.7	46.7	32 59.8	35.4
Y 14	249 31.7	14 04.3	53.9	102 10.6	52.0	216 21.5	46.6	48 02.0	35.5
15	264 34.2	29 03.6	54.7	117 11.7	51.6	231 24.3	46.5	63 04.2	35.7
16	279 36.7	44 02.8	55.5	132 12.9	51.2	246 27.1	46.4	78 06.4	35.8
17	294 39.1	59 02.1	56.3	147 14.0	50.8	261 29.9	46.2	93 08.5	35.9
18	309 41.6	74 01.4	S19 57.1	162 15.2	N14 50.4	276 32.7	N11 46.1	108 10.7	S 6 36.0
19	324 44.1	89 00.6	57.9	177 16.3	50.0	291 35.5	46.0	123 12.9	36.1
20	339 46.5	103 59.9	58.7	192 17.5	49.6	306 38.3	45.9	138 15.1	36.2
21	354 49.0	118 59.2	19 59.5	207 18.7	49.2	321 41.1	45.8	153 17.3	36.3
22	9 51.5	133 58.4	20 00.3	222 19.8	48.7	336 43.8	45.7	168 19.5	36.4
23	24 53.9	148 57.7	01.1	237 21.0	48.3	351 46.6	45.6	183 21.7	36.5
1 00	39 56.4	163 57.0	S20 01.9	252 22.1	N14 47.9	6 49.4	N11 45.5	198 23.8	S 6 36.6
01	54 58.8	178 56.2	02.7	267 23.3	47.5	21 52.2	45.4	213 26.0	36.7
02	70 01.3	193 55.5	03.5	282 24.4	47.1	36 55.0	45.3	228 28.2	36.8
03	85 03.8	208 54.8	04.3	297 25.6	46.7	51 57.8	45.2	243 30.4	36.9
04	100 06.2	223 54.0	05.1	312 26.7	46.3	67 00.6	45.0	258 32.6	37.1
05	115 08.7	238 53.3	05.9	327 27.9	45.9	82 03.4	44.9	273 34.8	37.2
06	130 11.2	253 52.5	S20 06.6	342 29.0	N14 45.5	97 06.2	N11 44.8	288 36.9	S 6 37.3
07	145 13.6	268 51.8	07.4	357 30.2	45.1	112 09.0	44.7	303 39.1	37.4
T 08	160 16.1	283 51.1	08.2	12 31.4	44.7	127 11.8	44.6	318 41.3	37.5
U 09	175 18.6	298 50.3	09.0	27 32.5	44.3	142 14.5	44.5	333 43.5	37.6
E 10	190 21.0	313 49.6	09.8	42 33.7	43.9	157 17.3	44.4	348 45.7	37.7
S 11	205 23.5	328 48.8	10.6	57 34.8	43.5	172 20.1	44.3	3 47.9	37.8
D 12	220 26.0	343 48.1	S20 11.4	72 36.0	N14 43.1	187 22.9	N11 44.2	18 50.1	S 6 37.9
A 13	235 28.4	358 47.4	12.2	87 37.1	42.7	202 25.7	44.1	33 52.2	38.0
Y 14	250 30.9	13 46.6	13.0	102 38.3	42.3	217 28.5	44.0	48 54.4	38.1
15	265 33.3	28 45.9	13.7	117 39.5	41.8	232 31.3	43.9	63 56.6	38.2
16	280 35.8	43 45.1	14.5	132 40.6	41.4	247 34.1	43.7	78 58.8	38.3
17	295 38.3	58 44.4	15.3	147 41.8	41.0	262 36.9	43.6	94 01.0	38.5
18	310 40.7	73 43.6	S20 16.1	162 42.9	N14 40.6	277 39.7	N11 43.5	109 03.2	S 6 38.6
19	325 43.2	88 42.9	16.9	177 44.1	40.2	292 42.5	43.4	124 05.4	38.7
20	340 45.7	103 42.1	17.6	192 45.3	39.8	307 45.2	43.3	139 07.5	38.8
21	355 48.1	118 41.4	18.4	207 46.4	39.4	322 48.0	43.2	154 09.7	38.9
22	10 50.6	133 40.7	19.2	222 47.6	39.0	337 50.8	43.1	169 11.9	39.0
23	25 53.1	148 39.9	20.0	237 48.7	38.6	352 53.6	43.0	184 14.1	39.1
2 00	40 55.5	163 39.2	S20 20.7	252 49.9	N14 38.2	7 56.4	N11 42.9	199 16.3	S 6 39.2
01	55 58.0	178 38.4	21.5	267 51.1	37.8	22 59.2	42.8	214 18.5	39.3
02	71 00.4	193 37.7	22.3	282 52.2	37.4	38 02.0	42.7	229 20.7	39.4
03	86 02.9	208 36.9	23.1	297 53.4	37.0	53 04.8	42.5	244 22.8	39.5
04	101 05.4	223 36.2	23.8	312 54.6	36.6	68 07.6	42.4	259 25.0	39.6
05	116 07.8	238 35.4	24.6	327 55.7	36.2	83 10.4	42.3	274 27.2	39.7
06	131 10.3	253 34.7	S20 25.4	342 56.9	N14 35.8	98 13.1	N11 42.2	289 29.4	S 6 39.8
W 07	146 12.8	268 33.9	26.1	357 58.1	35.3	113 15.9	42.1	304 31.6	40.0
E 08	161 15.2	283 33.2	26.9	12 59.2	34.9	128 18.7	42.0	319 33.8	40.1
D 09	176 17.7	298 32.4	27.7	28 00.4	34.5	143 21.5	41.9	334 36.0	40.2
N 10	191 20.2	313 31.7	28.4	43 01.5	34.1	158 24.3	41.8	349 38.1	40.3
E 11	206 22.6	328 30.9	29.2	58 02.7	33.7	173 27.1	41.7	4 40.3	40.4
S 12	221 25.1	343 30.1	S20 30.0	73 03.9	N14 33.3	188 29.9	N11 41.6	19 42.5	S 6 40.5
D 13	236 27.6	358 29.4	30.7	88 05.0	32.9	203 32.7	41.5	34 44.7	40.6
A 14	251 30.0	13 28.6	31.5	103 06.2	32.5	218 35.5	41.4	49 46.9	40.7
Y 15	266 32.5	28 27.9	32.2	118 07.4	32.1	233 38.3	41.2	64 49.1	40.8
16	281 34.9	43 27.1	33.0	133 08.5	31.7	248 41.0	41.1	79 51.3	40.9
17	296 37.4	58 26.4	33.8	148 09.7	31.3	263 43.8	41.0	94 53.4	41.0
18	311 39.9	73 25.6	S20 34.5	163 10.9	N14 30.9	278 46.6	N11 40.9	109 55.6	S 6 41.1
19	326 42.3	88 24.9	35.3	178 12.1	30.5	293 49.4	40.8	124 57.8	41.2
20	341 44.8	103 24.1	36.0	193 13.2	30.1	308 52.2	40.7	140 00.0	41.3
21	356 47.3	118 23.3	36.8	208 14.4	29.7	323 55.0	40.6	155 02.2	41.4
22	11 49.7	133 22.6	37.5	223 15.6	29.3	338 57.8	40.5	170 04.4	41.6
23	26 52.2	148 21.8	38.3	238 16.7	28.9	354 00.6	40.4	185 06.6	41.7
	h m								
Mer. Pass.	21 16.7	v −0.7	d 0.8	v 1.2	d 0.4	v 2.8	d 0.1	v 2.2	d 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.3
Achernar	335 27.0	S57 10.6
Acrux	173 11.2	S63 09.8
Adhara	255 13.3	S28 59.2
Aldebaran	290 50.4	N16 32.0
Alioth	166 22.2	N55 53.6
Alkaid	153 00.2	N49 15.2
Al Na'ir	27 45.0	S46 54.2
Alnilam	275 47.3	S 1 11.6
Alphard	217 57.3	S 8 42.6
Alphecca	126 12.3	N26 40.6
Alpheratz	357 44.4	N29 09.6
Altair	62 09.5	N 8 54.2
Ankaa	353 16.4	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.3
Atria	107 31.4	S69 03.0
Avior	234 18.5	S59 32.6
Bellatrix	278 33.0	N 6 21.6
Betelgeuse	271 02.3	N 7 24.5
Canopus	263 56.4	S52 41.9
Capella	280 35.8	N46 00.4
Deneb	49 32.3	N45 19.8
Denebola	182 35.1	N14 30.3
Diphda	348 56.7	S17 55.2
Dubhe	193 53.4	N61 40.9
Elnath	278 13.8	N28 37.0
Eltanin	90 47.0	N51 29.6
Enif	33 48.2	N 9 56.0
Fomalhaut	15 25.0	S29 33.5
Gacrux	172 02.8	S57 10.6
Gienah	175 53.8	S17 36.4
Hadar	148 50.2	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.1	N74 06.4
Markab	13 39.3	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.4	S36 25.6
Miaplacidus	221 40.1	S69 45.7
Mirfak	308 41.5	N49 54.2
Nunki	75 59.9	S26 16.8
Peacock	53 21.1	S56 41.9
Pollux	243 29.0	N27 59.7
Procyon	245 00.8	N 5 11.6
Rasalhague	96 07.8	N12 33.3
Regulus	207 44.9	N11 54.5
Rigel	281 12.9	S 8 11.2
Rigil Kent.	139 54.0	S60 53.0
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.4
Shaula	96 23.8	S37 06.7
Sirius	258 34.6	S16 43.9
Spica	158 32.8	S11 13.3
Suhail	222 53.4	S43 28.6
Vega	80 40.0	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	124 00.6	13 05
Mars	212 25.7	7 10
Jupiter	326 53.0	23 28
Saturn	158 27.5	10 45

2011 OCT. 31, NOV. 1, 2 (MON., TUES., WED.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
31 00	184 05.2	S13 55.1	124 22.6	6.4	S21 38.2	4.1	58.6
01	199 05.2	56.0	138 48.0	6.6	21 34.1	4.3	58.6
02	214 05.2	56.8	153 13.6	6.6	21 29.8	4.4	58.6
03	229 05.3	. . 57.6	167 39.2	6.8	21 25.4	4.5	58.5
04	244 05.3	58.4	182 05.0	6.8	21 20.9	4.6	58.5
05	259 05.3	13 59.2	196 30.8	6.9	21 16.3	4.8	58.4
06	274 05.4	S14 00.0	210 56.7	7.0	S21 11.5	4.9	58.4
07	289 05.4	00.8	225 22.7	7.2	21 06.6	5.0	58.4
08	304 05.4	01.7	239 48.9	7.2	21 01.6	5.1	58.3
M 09	319 05.4	. . 02.5	254 15.1	7.3	20 56.5	5.2	58.3
O 10	334 05.5	03.3	268 41.4	7.3	20 51.3	5.4	58.2
N 11	349 05.5	04.1	283 07.7	7.5	20 45.9	5.5	58.2
D 12	4 05.5	S14 04.9	297 34.2	7.6	S20 40.4	5.6	58.2
A 13	19 05.5	05.7	312 00.8	7.7	20 34.8	5.7	58.1
Y 14	34 05.6	06.5	326 27.5	7.8	20 29.1	5.8	58.1
15	49 05.6	. . 07.3	340 54.3	7.9	20 23.3	6.0	58.0
16	64 05.6	08.1	355 21.2	7.9	20 17.3	6.0	58.0
17	79 05.6	09.0	9 48.1	8.1	20 11.3	6.2	58.0
18	94 05.7	S14 09.8	24 15.2	8.2	S20 05.1	6.2	57.9
19	109 05.7	10.6	38 42.4	8.2	19 58.9	6.4	57.9
20	124 05.7	11.4	53 09.6	8.4	19 52.5	6.5	57.8
21	139 05.7	. . 12.2	67 37.0	8.5	19 46.0	6.6	57.8
22	154 05.8	13.0	82 04.5	8.5	19 39.4	6.7	57.8
23	169 05.8	13.8	96 32.0	8.7	19 32.7	6.8	57.7
1 00	184 05.8	S14 14.6	110 59.7	8.7	S19 25.9	6.9	57.7
01	199 05.8	15.4	125 27.4	8.9	19 19.0	7.0	57.6
02	214 05.8	16.2	139 55.3	9.0	19 12.0	7.0	57.6
03	229 05.9	. . 17.0	154 23.3	9.0	19 05.0	7.2	57.6
04	244 05.9	17.8	168 51.3	9.2	18 57.8	7.3	57.5
05	259 05.9	18.6	183 19.5	9.2	18 50.5	7.4	57.5
06	274 05.9	S14 19.4	197 47.7	9.4	S18 43.1	7.4	57.4
07	289 05.9	20.2	212 16.1	9.4	18 35.7	7.6	57.4
T 08	304 06.0	21.0	226 44.5	9.5	18 28.1	7.7	57.4
U 09	319 06.0	. . 21.8	241 13.0	9.7	18 20.4	7.7	57.3
E 10	334 06.0	22.7	255 41.7	9.7	18 12.7	7.8	57.3
S 11	349 06.0	23.5	270 10.4	9.9	18 04.9	7.9	57.3
D 12	4 06.0	S14 24.3	284 39.3	9.9	S17 57.0	8.0	57.2
A 13	19 06.1	25.1	299 08.2	10.0	17 49.0	8.1	57.2
Y 14	34 06.1	25.9	313 37.2	10.1	17 40.9	8.2	57.1
15	49 06.1	. . 26.7	328 06.3	10.3	17 32.7	8.2	57.1
16	64 06.1	27.5	342 35.6	10.3	17 24.5	8.4	57.1
17	79 06.1	28.3	357 04.9	10.4	17 16.1	8.4	57.0
18	94 06.1	S14 29.1	11 34.3	10.5	S17 07.7	8.4	57.0
19	109 06.2	29.9	26 03.8	10.6	16 59.3	8.6	56.9
20	124 06.2	30.7	40 33.4	10.7	16 50.7	8.6	56.9
21	139 06.2	. . 31.4	55 03.1	10.7	16 42.1	8.7	56.9
22	154 06.2	32.2	69 32.8	10.9	16 33.4	8.8	56.8
23	169 06.2	33.0	84 02.7	11.0	16 24.6	8.9	56.8
2 00	184 06.2	S14 33.8	98 32.7	11.0	S16 15.7	8.9	56.8
01	199 06.2	34.6	113 02.7	11.2	16 06.8	9.0	56.7
02	214 06.3	35.4	127 32.9	11.2	15 57.8	9.1	56.7
03	229 06.3	. . 36.2	142 03.1	11.4	15 48.7	9.1	56.7
04	244 06.3	37.0	156 33.5	11.4	15 39.6	9.2	56.6
05	259 06.3	37.8	171 03.9	11.5	15 30.4	9.3	56.6
06	274 06.3	S14 38.6	185 34.4	11.6	S15 21.1	9.3	56.5
W 07	289 06.3	39.4	200 05.0	11.7	15 11.8	9.4	56.5
E 08	304 06.3	40.2	214 35.7	11.7	15 02.4	9.4	56.5
D 09	319 06.3	. . 41.0	229 06.4	11.9	14 53.0	9.6	56.4
N 10	334 06.3	41.8	243 37.3	11.9	14 43.4	9.5	56.4
E 11	349 06.4	42.6	258 08.2	12.0	14 33.9	9.7	56.4
S 12	4 06.4	S14 43.4	272 39.2	12.1	S14 24.2	9.6	56.3
D 13	19 06.4	44.2	287 10.3	12.2	14 14.6	9.8	56.3
A 14	34 06.4	45.0	301 41.5	12.3	14 04.8	9.8	56.3
Y 15	49 06.4	. . 45.7	316 12.8	12.3	13 55.0	9.8	56.2
16	64 06.4	46.5	330 44.1	12.5	13 45.2	9.9	56.2
17	79 06.4	47.3	345 15.6	12.5	13 35.3	10.0	56.2
18	94 06.4	S14 48.1	359 47.1	12.6	S13 25.3	10.0	56.1
19	109 06.4	48.9	14 18.7	12.6	13 15.3	10.1	56.1
20	124 06.4	49.7	28 50.3	12.8	13 05.2	10.1	56.1
21	139 06.4	. . 50.5	43 22.1	12.8	12 55.1	10.1	56.0
22	154 06.4	51.3	57 53.9	12.9	12 45.0	10.3	56.0
23	169 06.5	52.0	72 25.8	13.0	S12 34.7	10.2	56.0
	SD 16.1	d 0.8	SD 15.8		15.6		15.4

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 31	Moonrise 1	Moonrise 2	Moonrise 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 05	07 27	08 54	▬	16 14	15 16	14 49
N 70	06 01	07 15	08 29	▬	15 12	14 49	14 34
68	05 57	07 04	08 09	14 48	14 36	14 28	14 22
66	05 54	06 56	07 54	14 05	14 10	14 12	14 12
64	05 51	06 48	07 41	13 36	13 50	13 58	14 03
62	05 49	06 42	07 30	13 14	13 34	13 47	13 56
60	05 47	06 36	07 21	12 56	13 20	13 37	13 49
N 58	05 44	06 31	07 13	12 41	13 09	13 29	13 44
56	05 42	06 26	07 06	12 28	12 58	13 21	13 39
54	05 40	06 22	07 00	12 16	12 49	13 14	13 34
52	05 39	06 19	06 54	12 07	12 41	13 08	13 30
50	05 37	06 15	06 49	11 58	12 34	13 03	13 26
45	05 33	06 07	06 38	11 39	12 18	12 51	13 18
N 40	05 28	06 00	06 29	11 23	12 05	12 41	13 11
35	05 25	05 54	06 21	11 10	11 54	12 32	13 05
30	05 21	05 49	06 14	10 59	11 45	12 25	13 00
20	05 12	05 39	06 01	10 39	11 28	12 12	12 51
N 10	05 04	05 29	05 50	10 22	11 13	12 00	12 43
0	04 54	05 19	05 40	10 06	11 00	11 50	12 36
S 10	04 43	05 08	05 30	09 50	10 46	11 39	12 28
20	04 29	04 56	05 19	09 33	10 31	11 27	12 20
30	04 11	04 41	05 06	09 13	10 15	11 14	12 11
35	03 59	04 31	04 58	09 02	10 05	11 06	12 06
40	03 45	04 21	04 50	08 48	09 54	10 58	12 00
45	03 28	04 07	04 39	08 33	09 40	10 47	11 53
S 50	03 05	03 51	04 27	08 13	09 24	10 35	11 44
52	02 54	03 43	04 21	08 04	09 16	10 29	11 40
54	02 41	03 34	04 15	07 54	09 08	10 23	11 36
56	02 25	03 24	04 08	07 42	08 58	10 16	11 31
58	02 06	03 13	04 00	07 29	08 48	10 07	11 26
S 60	01 42	02 59	03 51	07 13	08 35	09 58	11 20

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 31	Moonset 1	Moonset 2	Moonset 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	14 31	15 58	17 21	▬	18 26	21 05	23 06
N 70	14 57	16 11	17 25	▬	19 27	21 31	23 19
68	15 17	16 22	17 28	18 00	20 02	21 50	23 30
66	15 32	16 30	17 32	18 42	20 26	22 05	23 39
64	15 45	16 38	17 35	19 11	20 46	22 18	23 46
62	15 56	16 44	17 37	19 33	21 01	22 28	23 52
60	16 05	16 50	17 40	19 50	21 14	22 37	23 57
N 58	16 13	16 55	17 42	20 05	21 25	22 45	24 02
56	16 20	17 00	17 44	20 17	21 35	22 52	24 06
54	16 27	17 04	17 46	20 28	21 43	22 58	24 10
52	16 32	17 08	17 48	20 38	21 51	23 03	24 14
50	16 38	17 11	17 50	20 46	21 58	23 08	24 17
45	16 49	17 19	17 54	21 05	22 12	23 19	24 23
N 40	16 58	17 26	17 58	21 19	22 24	23 28	24 29
35	17 06	17 32	18 02	21 32	22 35	23 35	24 34
30	17 13	17 38	18 06	21 43	22 43	23 42	24 38
20	17 26	17 48	18 15	22 01	22 59	23 53	24 45
N 10	17 37	17 58	18 23	22 17	23 12	24 03	00 03
0	17 47	18 08	18 33	22 32	23 24	24 12	00 12
S 10	17 58	18 19	18 45	22 47	23 36	24 21	00 21
20	18 09	18 32	18 59	23 03	23 49	24 31	00 31
30	18 22	18 47	19 17	23 21	24 04	00 04	00 42
35	18 30	18 57	19 29	23 32	24 13	00 13	00 48
40	18 38	19 07	19 43	23 44	24 22	00 22	00 55
45	18 49	19 21	20 01	23 58	24 34	00 34	01 04
S 50	19 01	19 37	20 24	24 15	00 15	00 47	01 13
52	19 07	19 45	20 35	24 23	00 23	00 54	01 18
54	19 13	19 54	20 48	24 32	00 32	01 01	01 23
56	19 20	20 05	21 04	00 05	00 42	01 08	01 29
58	19 29	20 16	21 24	00 19	00 53	01 17	01 35
S 60	19 38	20 30	21 50	00 35	01 06	01 27	01 42

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
31	16 21	16 22	11 44	16 19	03 51	05	28
1	16 23	16 24	11 44	17 12	04 46	06	38
2	16 25	16 25	11 44	18 01	05 37	07	48

UT	ARIES	VENUS −3.8		MARS +1.1		JUPITER −2.9		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
3 00	41 54.7	163 21.1	S20 39.0	253 17.9	N14 28.4	9 03.4	N11 40.3	200 08.7	S 6 41.8
01	56 57.1	178 20.3	39.8	268 19.1	28.0	24 06.1	40.2	215 10.9	41.9
02	71 59.6	193 19.5	40.5	283 20.2	27.6	39 08.9	40.1	230 13.1	42.0
03	87 02.1	208 18.8	41.3	298 21.4	27.2	54 11.7	39.9	245 15.3	42.1
04	102 04.5	223 18.0	42.0	313 22.6	26.8	69 14.5	39.8	260 17.5	42.2
05	117 07.0	238 17.2	42.8	328 23.8	26.4	84 17.3	39.7	275 19.7	42.3
06	132 09.4	253 16.5	S20 43.5	343 24.9	N14 26.0	99 20.1	N11 39.6	290 21.9	S 6 42.4
07	147 11.9	268 15.7	44.3	358 26.1	25.6	114 22.9	39.5	305 24.0	42.5
T 08	162 14.4	283 15.0	45.0	13 27.3	25.2	129 25.7	39.4	320 26.2	42.6
H 09	177 16.8	298 14.2	45.8	28 28.4	24.8	144 28.5	39.3	335 28.4	42.7
U 10	192 19.3	313 13.4	46.5	43 29.6	24.4	159 31.2	39.2	350 30.6	42.8
R 11	207 21.8	328 12.7	47.2	58 30.8	24.0	174 34.0	39.1	5 32.8	42.9
S 12	222 24.2	343 11.9	S20 48.0	73 32.0	N14 23.6	189 36.8	N11 39.0	20 35.0	S 6 43.0
D 13	237 26.7	358 11.1	48.7	88 33.1	23.2	204 39.6	38.9	35 37.2	43.1
A 14	252 29.2	13 10.4	49.5	103 34.3	22.8	219 42.4	38.8	50 39.4	43.3
Y 15	267 31.6	28 09.6	50.2	118 35.5	22.4	234 45.2	38.7	65 41.5	43.4
16	282 34.1	43 08.8	50.9	133 36.7	21.9	249 48.0	38.5	80 43.7	43.5
17	297 36.5	58 08.1	51.7	148 37.8	21.5	264 50.8	38.4	95 45.9	43.6
18	312 39.0	73 07.3	S20 52.4	163 39.0	N14 21.1	279 53.5	N11 38.3	110 48.1	S 6 43.7
19	327 41.5	88 06.5	53.1	178 40.2	20.7	294 56.3	38.2	125 50.3	43.8
20	342 43.9	103 05.7	53.9	193 41.4	20.3	309 59.1	38.1	140 52.5	43.9
21	357 46.4	118 05.0	54.6	208 42.5	19.9	325 01.9	38.0	155 54.7	44.0
22	12 48.9	133 04.2	55.3	223 43.7	19.5	340 04.7	37.9	170 56.8	44.1
23	27 51.3	148 03.4	56.0	238 44.9	19.1	355 07.5	37.8	185 59.0	44.2
4 00	42 53.8	163 02.7	S20 56.8	253 46.1	N14 18.7	10 10.3	N11 37.7	201 01.2	S 6 44.3
01	57 56.3	178 01.9	57.5	268 47.3	18.3	25 13.1	37.6	216 03.4	44.4
02	72 58.7	193 01.1	58.2	283 48.4	17.9	40 15.8	37.5	231 05.6	44.5
03	88 01.2	208 00.3	59.0	298 49.6	17.5	55 18.6	37.4	246 07.8	44.6
04	103 03.7	222 59.6	20 59.7	313 50.8	17.1	70 21.4	37.3	261 10.0	44.7
05	118 06.1	237 58.8	21 00.4	328 52.0	16.7	85 24.2	37.1	276 12.2	44.8
06	133 08.6	252 58.0	S21 01.1	343 53.2	N14 16.3	100 27.0	N11 37.0	291 14.3	S 6 45.0
07	148 11.0	267 57.2	01.8	358 54.3	15.9	115 29.8	36.9	306 16.5	45.1
08	163 13.5	282 56.5	02.6	13 55.5	15.4	130 32.6	36.8	321 18.7	45.2
F 09	178 16.0	297 55.7	03.3	28 56.7	15.0	145 35.4	36.7	336 20.9	45.3
R 10	193 18.4	312 54.9	04.0	43 57.9	14.6	160 38.1	36.6	351 23.1	45.4
I 11	208 20.9	327 54.1	04.7	58 59.1	14.2	175 40.9	36.5	6 25.3	45.5
D 12	223 23.4	342 53.3	S21 05.4	74 00.2	N14 13.8	190 43.7	N11 36.4	21 27.5	S 6 45.6
A 13	238 25.8	357 52.6	06.1	89 01.4	13.4	205 46.5	36.3	36 29.7	45.7
Y 14	253 28.3	12 51.8	06.9	104 02.6	13.0	220 49.3	36.2	51 31.8	45.8
15	268 30.8	27 51.0	07.6	119 03.8	12.6	235 52.1	36.1	66 34.0	45.9
16	283 33.2	42 50.2	08.3	134 05.0	12.2	250 54.9	36.0	81 36.2	46.0
17	298 35.7	57 49.4	09.0	149 06.2	11.8	265 57.7	35.9	96 38.4	46.1
18	313 38.2	72 48.7	S21 09.7	164 07.3	N14 11.4	281 00.4	N11 35.8	111 40.6	S 6 46.2
19	328 40.6	87 47.9	10.4	179 08.5	11.0	296 03.2	35.6	126 42.8	46.3
20	343 43.1	102 47.1	11.1	194 09.7	10.6	311 06.0	35.5	141 45.0	46.4
21	358 45.5	117 46.3	11.8	209 10.9	10.2	326 08.8	35.4	156 47.2	46.5
22	13 48.0	132 45.5	12.5	224 12.1	09.8	341 11.6	35.3	171 49.3	46.6
23	28 50.5	147 44.7	13.2	239 13.3	09.4	356 14.4	35.2	186 51.5	46.7
5 00	43 52.9	162 44.0	S21 13.9	254 14.5	N14 09.0	11 17.2	N11 35.1	201 53.7	S 6 46.9
01	58 55.4	177 43.2	14.6	269 15.6	08.5	26 19.9	35.0	216 55.9	47.0
02	73 57.9	192 42.4	15.3	284 16.8	08.1	41 22.7	34.9	231 58.1	47.1
03	89 00.3	207 41.6	16.0	299 18.0	07.7	56 25.5	34.8	247 00.3	47.2
04	104 02.8	222 40.8	16.7	314 19.2	07.3	71 28.3	34.7	262 02.5	47.3
05	119 05.3	237 40.0	17.4	329 20.4	06.9	86 31.1	34.6	277 04.7	47.4
06	134 07.7	252 39.2	S21 18.1	344 21.6	N14 06.5	101 33.9	N11 34.5	292 06.9	S 6 47.5
07	149 10.2	267 38.5	18.8	359 22.8	06.1	116 36.7	34.4	307 09.0	47.6
S 08	164 12.6	282 37.7	19.5	14 24.0	05.7	131 39.4	34.3	322 11.2	47.7
A 09	179 15.1	297 36.9	20.2	29 25.1	05.3	146 42.2	34.2	337 13.4	47.8
T 10	194 17.6	312 36.1	20.9	44 26.3	04.9	161 45.0	34.0	352 15.6	47.9
U 11	209 20.0	327 35.3	21.6	59 27.5	04.5	176 47.8	33.9	7 17.8	48.0
R 12	224 22.5	342 34.5	S21 22.3	74 28.7	N14 04.1	191 50.6	N11 33.8	22 20.0	S 6 48.1
D 13	239 25.0	357 33.7	23.0	89 29.9	03.7	206 53.4	33.7	37 22.2	48.2
A 14	254 27.4	12 32.9	23.7	104 31.1	03.3	221 56.1	33.6	52 24.4	48.3
Y 15	269 29.9	27 32.1	24.3	119 32.3	02.9	236 58.9	33.5	67 26.5	48.4
16	284 32.4	42 31.3	25.0	134 33.5	02.5	252 01.7	33.4	82 28.7	48.5
17	299 34.8	57 30.5	25.7	149 34.7	02.1	267 04.5	33.3	97 30.9	48.6
18	314 37.3	72 29.7	S21 26.4	164 35.9	N14 01.6	282 07.3	N11 33.2	112 33.1	S 6 48.7
19	329 39.8	87 29.0	27.1	179 37.1	01.2	297 10.1	33.1	127 35.3	48.9
20	344 42.2	102 28.2	27.8	194 38.2	00.8	312 12.9	33.0	142 37.5	49.0
21	359 44.7	117 27.4	28.4	209 39.4	00.4	327 15.6	32.9	157 39.7	49.1
22	14 47.1	132 26.6	29.1	224 40.6	14 00.0	342 18.4	32.8	172 41.9	49.2
23	29 49.6	147 25.8	29.8	239 41.8	N13 59.6	357 21.2	32.7	187 44.1	49.3
	h m								
Mer. Pass.	21 05.0	v −0.8	d 0.7	v 1.2	d 0.4	v 2.8	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.3
Achernar	335 27.0	S57 10.6
Acrux	173 11.2	S63 09.8
Adhara	255 13.3	S28 59.2
Aldebaran	290 50.4	N16 32.0
Alioth	166 22.1	N55 53.6
Alkaid	153 00.2	N49 15.2
Al Na'ir	27 45.0	S46 54.2
Alnilam	275 47.3	S 1 11.6
Alphard	217 57.3	S 8 42.6
Alphecca	126 12.3	N26 40.6
Alpheratz	357 44.4	N29 09.6
Altair	62 09.5	N 8 54.2
Ankaa	353 16.4	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.3
Atria	107 31.4	S69 03.0
Avior	234 18.4	S59 32.6
Bellatrix	278 33.0	N 6 21.6
Betelgeuse	271 02.3	N 7 24.5
Canopus	263 56.3	S52 41.9
Capella	280 35.8	N46 00.5
Deneb	49 32.3	N45 19.8
Denebola	182 35.1	N14 30.3
Diphda	348 56.7	S17 55.2
Dubhe	193 53.4	N61 40.9
Elnath	278 13.8	N28 37.0
Eltanin	90 47.0	N51 29.5
Enif	33 48.2	N 9 56.0
Fomalhaut	15 25.0	S29 33.5
Gacrux	172 02.7	S57 10.6
Gienah	175 53.8	S17 36.4
Hadar	148 50.2	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.1	N74 06.4
Markab	13 39.3	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.4	S36 25.6
Miaplacidus	221 40.1	S69 45.7
Mirfak	308 41.5	N49 54.2
Nunki	75 59.9	S26 16.8
Peacock	53 21.1	S56 41.9
Pollux	243 29.0	N27 59.7
Procyon	245 00.8	N 5 11.6
Rasalhague	96 07.8	N12 33.3
Regulus	207 44.8	N11 54.5
Rigel	281 12.9	S 8 11.2
Rigil Kent.	139 54.0	S60 53.0
Sabik	102 14.1	S15 44.3
Schedar	349 41.4	N56 36.4
Shaula	96 23.8	S37 06.7
Sirius	258 34.5	S16 43.9
Spica	158 32.8	S11 13.3
Suhail	222 53.3	S43 28.6
Vega	80 40.0	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	120 08.9	13 09
Mars	210 52.3	7 04
Jupiter	327 16.5	23 15
Saturn	158 07.4	10 34

UT	SUN				MOON					
	GHA		Dec		GHA	v	Dec	d	HP	
d h	°	′	°	′	°	′	°	′	′	′
3 00	184	06.5	S14	52.8	86	57.8	13.0	S12	24.5	10.3	56.0
01	199	06.5		53.6	101	29.8	13.1	12	14.2	10.3	55.9
02	214	06.5		54.4	116	01.9	13.2	12	03.9	10.4	55.9
03	229	06.5	. .	55.2	130	34.1	13.3	11	53.5	10.5	55.9
04	244	06.5		56.0	145	06.4	13.3	11	43.0	10.4	55.8
05	259	06.5		56.8	159	38.7	13.4	11	32.6	10.5	55.8
06	274	06.5	S14	57.5	174	11.1	13.5	S11	22.1	10.6	55.8
07	289	06.5		58.3	188	43.6	13.5	11	11.5	10.6	55.7
08	304	06.5		59.1	203	16.1	13.6	11	00.9	10.6	55.7
09	319	06.5	14	59.9	217	48.7	13.7	10	50.3	10.7	55.7
10	334	06.5	15	00.7	232	21.4	13.7	10	39.6	10.7	55.7
11	349	06.5		01.5	246	54.1	13.8	10	28.9	10.7	55.6
12	4	06.5	S15	02.2	261	26.9	13.8	S10	18.2	10.8	55.6
13	19	06.5		03.0	275	59.7	14.0	10	07.4	10.8	55.6
14	34	06.5		03.8	290	32.7	13.9	9	56.6	10.8	55.5
15	49	06.5	. .	04.6	305	05.6	14.1	9	45.8	10.9	55.5
16	64	06.5		05.4	319	38.7	14.1	9	34.9	10.9	55.5
17	79	06.5		06.1	334	11.8	14.1	9	24.0	10.9	55.5
18	94	06.5	S15	06.9	348	44.9	14.3	S 9	13.1	10.9	55.4
19	109	06.5		07.7	3	18.2	14.2	9	02.2	11.0	55.4
20	124	06.5		08.5	17	51.4	14.4	8	51.2	11.0	55.4
21	139	06.5	. .	09.3	32	24.8	14.3	8	40.2	11.1	55.4
22	154	06.5		10.0	46	58.1	14.5	8	29.1	11.0	55.3
23	169	06.5		10.8	61	31.6	14.5	8	18.1	11.1	55.3
4 00	184	06.5	S15	11.6	76	05.1	14.5	S 8	07.0	11.1	55.3
01	199	06.5		12.4	90	38.6	14.6	7	55.9	11.2	55.2
02	214	06.5		13.1	105	12.2	14.6	7	44.7	11.1	55.2
03	229	06.5	. .	13.9	119	45.8	14.7	7	33.6	11.2	55.2
04	244	06.5		14.7	134	19.5	14.8	7	22.4	11.2	55.2
05	259	06.5		15.5	148	53.3	14.8	7	11.2	11.2	55.2
06	274	06.5	S15	16.2	163	27.1	14.8	S 7	00.0	11.3	55.1
07	289	06.5		17.0	178	00.9	14.9	6	48.7	11.3	55.1
08	304	06.5		17.8	192	34.8	14.9	6	37.4	11.2	55.1
09	319	06.5	. .	18.6	207	08.7	14.9	6	26.2	11.3	55.1
10	334	06.4		19.3	221	42.6	15.1	6	14.9	11.3	55.0
11	349	06.4		20.1	236	16.7	15.0	6	03.6	11.4	55.0
12	4	06.4	S15	20.9	250	50.7	15.1	S 5	52.2	11.3	55.0
13	19	06.4		21.6	265	24.8	15.1	5	40.9	11.4	55.0
14	34	06.4		22.4	279	58.9	15.2	5	29.5	11.4	54.9
15	49	06.4	. .	23.2	294	33.1	15.2	5	18.1	11.4	54.9
16	64	06.4		24.0	309	07.3	15.2	5	06.7	11.4	54.9
17	79	06.4		24.7	323	41.5	15.3	4	55.3	11.4	54.9
18	94	06.4	S15	25.5	338	15.8	15.3	S 4	43.9	11.4	54.9
19	109	06.4		26.3	352	50.1	15.4	4	32.5	11.4	54.8
20	124	06.4		27.0	7	24.5	15.3	4	21.1	11.5	54.8
21	139	06.4	. .	27.8	21	58.8	15.4	4	09.6	11.4	54.8
22	154	06.3		28.6	36	33.2	15.5	3	58.2	11.5	54.8
23	169	06.3		29.3	51	07.7	15.5	3	46.7	11.5	54.8
5 00	184	06.3	S15	30.1	65	42.2	15.5	S 3	35.2	11.4	54.7
01	199	06.3		30.9	80	16.7	15.5	3	23.8	11.5	54.7
02	214	06.3		31.6	94	51.2	15.5	3	12.3	11.5	54.7
03	229	06.3	. .	32.4	109	25.7	15.6	3	00.8	11.5	54.7
04	244	06.3		33.2	124	00.3	15.6	2	49.3	11.5	54.7
05	259	06.3		33.9	138	34.9	15.7	2	37.8	11.5	54.7
06	274	06.3	S15	34.7	153	09.6	15.6	S 2	26.3	11.5	54.6
07	289	06.2		35.4	167	44.2	15.7	2	14.8	11.5	54.6
08	304	06.2		36.2	182	18.9	15.7	2	03.3	11.5	54.6
09	319	06.2	. .	37.0	196	53.6	15.7	1	51.8	11.5	54.6
10	334	06.2		37.7	211	28.3	15.7	1	40.3	11.5	54.6
11	349	06.2		38.5	226	03.0	15.8	1	28.8	11.5	54.5
12	4	06.2	S15	39.2	240	37.8	15.8	S 1	17.3	11.5	54.5
13	19	06.2		40.0	255	12.6	15.8	1	05.8	11.5	54.5
14	34	06.1		40.8	269	47.4	15.8	0	54.3	11.5	54.5
15	49	06.1	. .	41.5	284	22.2	15.8	0	42.8	11.6	54.5
16	64	06.1		42.3	298	57.0	15.8	0	31.2	11.4	54.5
17	79	06.1		43.0	313	31.8	15.9	0	19.8	11.5	54.5
18	94	06.1	S15	43.8	328	06.7	15.9	S 0	08.3	11.5	54.4
19	109	06.1		44.6	342	41.6	15.8	N 0	03.2	11.5	54.4
20	124	06.0		45.3	357	16.4	15.9	0	14.7	11.5	54.4
21	139	06.0	. .	46.1	11	51.3	15.9	0	26.2	11.5	54.4
22	154	06.0		46.8	26	26.2	15.9	0	37.7	11.4	54.4
23	169	06.0		47.6	41	01.1	15.9	N 0	49.1	11.5	54.4
	SD	16.2	d	0.8	SD		15.1		15.0		14.9

THURSDAY

FRIDAY

SATURDAY

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 3	Moonrise 4	Moonrise 5	Moonrise 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 16	07 41	09 14	14 49	14 30	14 13	13 57
N 70	06 11	07 27	08 44	14 34	14 22	14 12	14 02
68	06 07	07 15	08 22	14 22	14 16	14 11	14 05
66	06 03	07 05	08 05	14 12	14 11	14 10	14 09
64	05 59	06 57	07 51	14 03	14 07	14 09	14 12
62	05 56	06 49	07 39	13 56	14 03	14 08	14 14
60	05 53	06 43	07 29	13 49	13 59	14 08	14 16
N 58	05 50	06 37	07 20	13 44	13 56	14 07	14 18
56	05 48	06 32	07 12	13 39	13 54	14 07	14 20
54	05 46	06 28	07 06	13 34	13 51	14 07	14 22
52	05 43	06 24	06 59	13 30	13 49	14 06	14 23
50	05 41	06 20	06 54	13 26	13 47	14 06	14 24
45	05 36	06 11	06 42	13 18	13 42	14 05	14 27
N 40	05 32	06 04	06 32	13 11	13 39	14 04	14 30
35	05 27	05 57	06 23	13 05	13 36	14 04	14 32
30	05 23	05 51	06 16	13 00	13 33	14 03	14 34
20	05 14	05 40	06 03	12 51	13 28	14 03	14 37
N 10	05 04	05 29	05 51	12 43	13 23	14 02	14 40
0	04 54	05 19	05 40	12 36	13 19	14 01	14 43
S 10	04 42	05 07	05 29	12 28	13 15	14 01	14 45
20	04 27	04 54	05 17	12 20	13 11	14 00	14 48
30	04 08	04 38	05 03	12 11	13 06	13 59	14 52
35	03 56	04 28	04 55	12 06	13 03	13 59	14 54
40	03 41	04 17	04 46	12 00	13 00	13 58	14 56
45	03 23	04 03	04 35	11 53	12 56	13 58	14 59
S 50	02 58	03 45	04 22	11 44	12 51	13 57	15 02
52	02 46	03 37	04 16	11 40	12 49	13 57	15 03
54	02 32	03 28	04 09	11 36	12 47	13 56	15 05
56	02 15	03 17	04 01	11 31	12 44	13 56	15 07
58	01 54	03 04	03 53	11 26	12 42	13 56	15 08
S 60	01 26	02 50	03 43	11 20	12 38	13 55	15 11

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 3	Moonset 4	Moonset 5	Moonset 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	14 12	15 44	17 09	23 06	24 55	00 55	02 40
N 70	14 42	15 59	17 14	23 19	25 00	01 00	02 38
68	15 04	16 11	17 19	23 30	25 04	01 04	02 36
66	15 21	16 21	17 23	23 39	25 08	01 08	02 34
64	15 36	16 29	17 27	23 46	25 11	01 11	02 33
62	15 47	16 37	17 30	23 52	25 13	01 13	02 32
60	15 57	16 43	17 33	23 57	25 15	01 15	02 31
N 58	16 06	16 49	17 36	24 02	00 02	01 17	02 31
56	16 14	16 54	17 38	24 06	00 06	01 19	02 30
54	16 21	16 59	17 41	24 10	00 10	01 20	02 29
52	16 27	17 03	17 43	24 14	00 14	01 22	02 29
50	16 33	17 07	17 45	24 17	00 17	01 23	02 28
45	16 45	17 15	17 50	24 23	00 23	01 26	02 27
N 40	16 55	17 23	17 55	24 29	00 29	01 28	02 26
35	17 03	17 30	18 00	24 34	00 34	01 30	02 25
30	17 11	17 36	18 04	24 38	00 38	01 32	02 25
20	17 24	17 47	18 13	24 45	00 45	01 35	02 23
N 10	17 36	17 58	18 23	00 03	00 51	01 37	02 22
0	17 47	18 08	18 33	00 12	00 57	01 40	02 21
S 10	17 58	18 20	18 46	00 21	01 03	01 42	02 20
20	18 10	18 33	19 01	00 31	01 09	01 44	02 19
30	18 24	18 50	19 20	00 42	01 16	01 47	02 18
35	18 32	19 00	19 32	00 48	01 20	01 49	02 17
40	18 42	19 11	19 47	00 55	01 24	01 51	02 16
45	18 53	19 25	20 06	01 04	01 29	01 53	02 15
S 50	19 06	19 43	20 30	01 13	01 35	01 55	02 14
52	19 12	19 52	20 43	01 18	01 38	01 56	02 13
54	19 19	20 01	20 57	01 23	01 41	01 58	02 13
56	19 27	20 12	21 15	01 29	01 45	01 59	02 12
58	19 36	20 25	21 36	01 35	01 49	02 00	02 11
S 60	19 46	20 40	22 06	01 42	01 53	02 02	02 11

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
3	16 26	16 26	11 44	18 46	06 24	08	58
4	16 26	16 26	11 44	19 30	07 08	09	68
5	16 25	16 25	11 44	20 11	07 50	10	76

UT	ARIES	VENUS −3.8		MARS +1.0		JUPITER −2.9		SATURN +0.7		STARS		
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Name	SHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
6 00	44 52.1	162 25.0	S21 30.5	254 43.0	N13 59.2	12 24.0	N11 32.6	202 46.2	S 6 49.4	Acamar	315 18.8	S40 15.4
01	59 54.5	177 24.2	31.2	269 44.2	58.8	27 26.8	32.5	217 48.4	49.5	Achernar	335 27.0	S57 10.6
02	74 57.0	192 23.4	31.8	284 45.4	58.4	42 29.6	32.3	232 50.6	49.6	Acrux	173 11.2	S63 09.7
03	89 59.5	207 22.6	32.5	299 46.6	58.0	57 32.3	32.2	247 52.8	49.7	Adhara	255 13.2	S28 59.2
04	105 01.9	222 21.8	33.2	314 47.8	57.6	72 35.1	32.1	262 55.0	49.8	Aldebaran	290 50.4	N16 32.0
05	120 04.4	237 21.0	33.9	329 49.0	57.2	87 37.9	32.0	277 57.2	49.9			
06	135 06.9	252 20.2	S21 34.5	344 50.2	N13 56.8	102 40.7	N11 31.9	292 59.4	S 6 50.0	Alioth	166 22.1	N55 53.5
07	150 09.3	267 19.4	35.2	359 51.4	56.4	117 43.5	31.8	308 01.6	50.1	Alkaid	153 00.2	N49 15.2
08	165 11.8	282 18.6	35.9	14 52.6	56.0	132 46.3	31.7	323 03.8	50.2	Al Na'ir	27 45.0	S46 54.3
S 09	180 14.2	297 17.8	36.5	29 53.8	55.6	147 49.0	31.6	338 05.9	50.3	Alnilam	275 47.3	S 1 11.6
U 10	195 16.7	312 17.0	37.2	44 55.0	55.2	162 51.8	31.5	353 08.1	50.4	Alphard	217 57.3	S 8 42.6
N 11	210 19.2	327 16.2	37.9	59 56.2	54.7	177 54.6	31.4	8 10.3	50.5			
D 12	225 21.6	342 15.4	S21 38.5	74 57.4	N13 54.3	192 57.4	N11 31.3	23 12.5	S 6 50.6	Alphecca	126 12.3	N26 40.6
A 13	240 24.1	357 14.6	39.2	89 58.6	53.9	208 00.2	31.2	38 14.7	50.7	Alpheratz	357 44.4	N29 09.6
Y 14	255 26.6	12 13.8	39.9	104 59.8	53.5	223 03.0	31.1	53 16.9	50.8	Altair	62 09.5	N 8 54.2
15	270 29.0	27 13.0	40.5	120 01.0	53.1	238 05.7	31.0	68 19.1	50.9	Ankaa	353 16.5	S42 14.5
16	285 31.5	42 12.2	41.2	135 02.2	52.7	253 08.5	30.9	83 21.3	51.0	Antares	112 28.0	S26 27.4
17	300 34.0	57 11.4	41.8	150 03.4	52.3	268 11.3	30.8	98 23.5	51.2			
18	315 36.4	72 10.6	S21 42.5	165 04.6	N13 51.9	283 14.1	N11 30.7	113 25.6	S 6 51.3	Arcturus	145 57.1	N19 07.3
19	330 38.9	87 09.7	43.2	180 05.8	51.5	298 16.9	30.6	128 27.8	51.4	Atria	107 31.4	S69 03.0
20	345 41.4	102 08.9	43.8	195 07.0	51.1	313 19.6	30.4	143 30.0	51.5	Avior	234 18.4	S59 32.6
21	0 43.8	117 08.1	44.5	210 08.2	50.7	328 22.4	30.3	158 32.2	51.6	Bellatrix	278 33.0	N 6 21.6
22	15 46.3	132 07.3	45.1	225 09.4	50.3	343 25.2	30.2	173 34.4	51.7	Betelgeuse	271 02.3	N 7 24.5
23	30 48.7	147 06.5	45.8	240 10.6	49.9	358 28.0	30.1	188 36.6	51.8			
7 00	45 51.2	162 05.7	S21 46.4	255 11.8	N13 49.5	13 30.8	N11 30.0	203 38.8	S 6 51.9	Canopus	263 56.3	S52 41.9
01	60 53.7	177 04.9	47.1	270 13.0	49.1	28 33.6	29.9	218 41.0	52.0	Capella	280 35.8	N46 00.5
02	75 56.1	192 04.1	47.7	285 14.2	48.7	43 36.3	29.8	233 43.2	52.1	Deneb	49 32.3	N45 19.8
03	90 58.6	207 03.3	48.4	300 15.4	48.3	58 39.1	29.7	248 45.4	52.2	Denebola	182 35.0	N14 30.3
04	106 01.1	222 02.5	49.0	315 16.6	47.9	73 41.9	29.6	263 47.5	52.3	Diphda	348 56.8	S17 55.2
05	121 03.5	237 01.7	49.7	330 17.8	47.4	88 44.7	29.5	278 49.7	52.4			
06	136 06.0	252 00.9	S21 50.3	345 19.0	N13 47.0	103 47.5	N11 29.4	293 51.9	S 6 52.5	Dubhe	193 53.4	N61 40.9
07	151 08.5	267 00.0	51.0	0 20.2	46.6	118 50.2	29.3	308 54.1	52.6	Elnath	278 13.8	N28 37.0
08	166 10.9	281 59.2	51.6	15 21.4	46.2	133 53.0	29.2	323 56.3	52.7	Eltanin	90 47.1	N51 29.5
M 09	181 13.4	296 58.4	52.3	30 22.6	45.8	148 55.8	29.1	338 58.5	52.8	Enif	33 48.2	N 9 56.0
O 10	196 15.9	311 57.6	52.9	45 23.8	45.4	163 58.6	29.0	354 00.7	52.9	Fomalhaut	15 25.1	S29 33.5
N 11	211 18.3	326 56.8	53.5	60 25.0	45.0	179 01.4	28.9	9 02.9	53.0			
D 12	226 20.8	341 56.0	S21 54.2	75 26.2	N13 44.6	194 04.1	N11 28.8	24 05.1	S 6 53.1	Gacrux	172 02.7	S57 10.6
A 13	241 23.2	356 55.2	54.8	90 27.4	44.2	209 06.9	28.7	39 07.3	53.2	Gienah	175 53.7	S17 36.4
Y 14	256 25.7	11 54.3	55.5	105 28.7	43.8	224 09.7	28.6	54 09.4	53.3	Hadar	148 50.2	S60 25.7
15	271 28.2	26 53.5	56.1	120 29.9	43.4	239 12.5	28.5	69 11.6	53.4	Hamal	328 01.7	N23 31.3
16	286 30.6	41 52.7	56.7	135 31.1	43.0	254 15.3	28.3	84 13.8	53.5	Kaus Aust.	83 45.6	S34 22.7
17	301 33.1	56 51.9	57.4	150 32.3	42.6	269 18.0	28.2	99 16.0	53.6			
18	316 35.6	71 51.1	S21 58.0	165 33.5	N13 42.2	284 20.8	N11 28.1	114 18.2	S 6 53.8	Kochab	137 21.1	N74 06.4
19	331 38.0	86 50.3	58.6	180 34.7	41.8	299 23.6	28.0	129 20.4	53.9	Markab	13 39.3	N15 16.4
20	346 40.5	101 49.4	59.3	195 35.9	41.4	314 26.4	27.9	144 22.6	54.0	Menkar	314 15.9	N 4 08.3
21	1 43.0	116 48.6	21 59.9	210 37.1	41.0	329 29.2	27.8	159 24.8	54.1	Menkent	148 09.3	S36 25.6
22	16 45.4	131 47.8	22 00.5	225 38.3	40.6	344 31.9	27.7	174 27.0	54.2	Miaplacidus	221 40.0	S69 45.7
23	31 47.9	146 47.0	01.1	240 39.5	40.2	359 34.7	27.6	189 29.2	54.3			
8 00	46 50.3	161 46.2	S22 01.8	255 40.7	N13 39.8	14 37.5	N11 27.5	204 31.4	S 6 54.4	Mirfak	308 41.5	N49 54.2
01	61 52.8	176 45.4	02.4	270 42.0	39.3	29 40.3	27.4	219 33.5	54.5	Nunki	75 59.9	S26 16.8
02	76 55.3	191 44.5	03.0	285 43.2	38.9	44 43.1	27.3	234 35.7	54.6	Peacock	53 21.1	S56 41.9
03	91 57.7	206 43.7	03.6	300 44.4	38.5	59 45.8	27.2	249 37.9	54.7	Pollux	243 29.0	N27 59.7
04	107 00.2	221 42.9	04.3	315 45.6	38.1	74 48.6	27.1	264 40.1	54.8	Procyon	245 00.8	N 5 11.6
05	122 02.7	236 42.1	04.9	330 46.8	37.7	89 51.4	27.0	279 42.3	54.9			
06	137 05.1	251 41.2	S22 05.5	345 48.0	N13 37.3	104 54.2	N11 26.9	294 44.5	S 6 55.0	Rasalhague	96 07.8	N12 33.3
07	152 07.6	266 40.4	06.1	♁ 49.2	36.9	119 56.9	26.8	309 46.7	55.1	Regulus	207 44.8	N11 54.5
T 08	167 10.1	281 39.6	06.8	15 50.4	36.5	134 59.7	26.7	324 48.9	55.2	Rigel	281 12.9	S 8 11.2
U 09	182 12.5	296 38.8	07.4	30 51.7	36.1	150 02.5	26.6	339 51.1	55.3	Rigil Kent.	139 54.0	S60 52.9
E 10	197 15.0	311 37.9	08.0	45 52.9	35.7	165 05.3	26.5	354 53.3	55.4	Sabik	102 14.2	S15 44.3
S 11	212 17.5	326 37.1	08.6	60 54.1	35.3	180 08.1	26.4	9 55.5	55.5			
D 12	227 19.9	341 36.3	S22 09.2	75 55.3	N13 34.9	195 10.8	N11 26.3	24 57.6	S 6 55.6	Schedar	349 41.4	N56 36.4
A 13	242 22.4	356 35.5	09.8	90 56.5	34.5	210 13.6	26.2	39 59.8	55.7	Shaula	96 23.8	S37 06.7
Y 14	257 24.8	11 34.6	10.4	105 57.7	34.1	225 16.4	26.1	55 02.0	55.8	Sirius	258 34.5	S16 43.9
15	272 27.3	26 33.8	11.0	120 58.9	33.7	240 19.2	26.0	70 04.2	55.9	Spica	158 32.8	S11 13.3
16	287 29.8	41 33.0	11.7	136 00.2	33.3	255 21.9	25.9	85 06.4	56.0	Suhail	222 53.3	S43 28.7
17	302 32.2	56 32.2	12.3	151 01.4	32.9	270 24.7	25.7	100 08.6	56.1			
18	317 34.7	71 31.3	S22 12.9	166 02.6	N13 32.5	285 27.5	N11 25.6	115 10.8	S 6 56.2	Vega	80 40.0	N38 48.0
19	332 37.2	86 30.5	13.5	181 03.8	32.1	300 30.3	25.5	130 13.0	56.3	Zuben'ubi	137 07.0	S16 05.4
20	347 39.6	101 29.7	14.1	196 05.0	31.7	315 33.1	25.4	145 15.2	56.4		SHA	Mer. Pass.
21	2 42.1	116 28.9	14.7	211 06.2	31.3	330 35.8	25.3	160 17.4	56.5		° ′	h m
22	17 44.6	131 28.0	15.3	226 07.5	30.8	345 38.6	25.2	175 19.6	56.6	Venus	116 14.5	13 12
23	32 47.0	146 27.2	15.9	241 08.7	30.4	0 41.4	25.1	190 21.8	56.7	Mars	209 20.6	6 59
	h m									Jupiter	327 39.6	23 02
Mer. Pass.	20 53.2	*v* −0.8	*d* 0.6	*v* 1.2	*d* 0.4	*v* 2.8	*d* 0.1	*v* 2.2	*d* 0.1	Saturn	157 47.6	10 24

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
6 00	184 06.0	S15 48.3	55 36.0	16.0	N 1 00.6	11.4	54.4
01	199 05.9	49.1	70 11.0	15.9	1 12.0	11.5	54.3
02	214 05.9	49.8	84 45.9	15.9	1 23.5	11.4	54.3
03	229 05.9	. . 50.6	99 20.8	16.0	1 34.9	11.4	54.3
04	244 05.9	51.4	113 55.8	15.9	1 46.3	11.4	54.3
05	259 05.9	52.1	128 30.7	16.0	1 57.7	11.4	54.3
06	274 05.8	S15 52.9	143 05.7	15.9	N 2 09.1	11.4	54.3
07	289 05.8	53.6	157 40.6	16.0	2 20.5	11.4	54.3
08	304 05.8	54.4	172 15.6	15.9	2 31.9	11.3	54.3
S 09	319 05.8	. . 55.1	186 50.5	16.0	2 43.2	11.4	54.3
U 10	334 05.7	55.9	201 25.5	15.9	2 54.6	11.3	54.2
N 11	349 05.7	56.6	216 00.4	16.0	3 05.9	11.3	54.2
D 12	4 05.7	S15 57.4	230 35.4	15.9	N 3 17.2	11.3	54.2
A 13	19 05.7	58.1	245 10.3	16.0	3 28.5	11.3	54.2
Y 14	34 05.6	58.9	259 45.3	15.9	3 39.8	11.3	54.2
15	49 05.6	15 59.6	274 20.2	15.9	3 51.1	11.2	54.2
16	64 05.6	16 00.4	288 55.1	16.0	4 02.3	11.2	54.2
17	79 05.6	01.1	303 30.1	15.9	4 13.5	11.2	54.2
18	94 05.5	S16 01.9	318 05.0	15.9	N 4 24.7	11.2	54.2
19	109 05.5	02.6	332 39.9	15.9	4 35.9	11.2	54.2
20	124 05.5	03.3	347 14.8	15.9	4 47.1	11.1	54.1
21	139 05.5	. . 04.1	1 49.7	15.9	4 58.2	11.2	54.1
22	154 05.4	04.8	16 24.6	15.8	5 09.4	11.1	54.1
23	169 05.4	05.6	30 59.4	15.9	5 20.5	11.1	54.1
7 00	184 05.4	S16 06.3	45 34.3	15.9	N 5 31.6	11.0	54.1
01	199 05.4	07.1	60 09.2	15.8	5 42.6	11.0	54.1
02	214 05.3	07.8	74 44.0	15.8	5 53.6	11.1	54.1
03	229 05.3	. . 08.6	89 18.8	15.8	6 04.7	10.9	54.1
04	244 05.3	09.3	103 53.6	15.8	6 15.6	11.0	54.1
05	259 05.2	10.0	118 28.4	15.8	6 26.6	10.9	54.1
06	274 05.2	S16 10.8	133 03.2	15.8	N 6 37.5	10.9	54.1
07	289 05.2	11.5	147 38.0	15.7	6 48.4	10.9	54.1
08	304 05.1	12.3	162 12.7	15.7	6 59.3	10.8	54.1
M 09	319 05.1	. . 13.0	176 47.4	15.7	7 10.1	10.9	54.1
O 10	334 05.1	13.7	191 22.1	15.7	7 21.0	10.8	54.1
N 11	349 05.1	14.5	205 56.8	15.7	7 31.8	10.7	54.0
D 12	4 05.0	S16 15.2	220 31.5	15.6	N 7 42.5	10.7	54.0
A 13	19 05.0	16.0	235 06.1	15.7	7 53.2	10.7	54.0
Y 14	34 05.0	16.7	249 40.8	15.6	8 03.9	10.7	54.0
15	49 04.9	. . 17.4	264 15.4	15.5	8 14.6	10.6	54.0
16	64 04.9	18.2	278 49.9	15.6	8 25.2	10.6	54.0
17	79 04.9	18.9	293 24.5	15.5	8 35.8	10.6	54.0
18	94 04.8	S16 19.6	307 59.0	15.5	N 8 46.4	10.5	54.0
19	109 04.8	20.4	322 33.5	15.5	8 56.9	10.5	54.0
20	124 04.7	21.1	337 08.0	15.5	9 07.4	10.5	54.0
21	139 04.7	. . 21.8	351 42.5	15.4	9 17.9	10.4	54.0
22	154 04.7	22.6	6 16.9	15.4	9 28.3	10.4	54.0
23	169 04.6	23.3	20 51.3	15.4	9 38.7	10.3	54.0
8 00	184 04.6	S16 24.0	35 25.7	15.3	N 9 49.0	10.3	54.0
01	199 04.6	24.8	50 00.0	15.3	9 59.3	10.3	54.0
02	214 04.5	25.5	64 34.3	15.3	10 09.6	10.2	54.0
03	229 04.5	. . 26.2	79 08.6	15.2	10 19.8	10.2	54.0
04	244 04.5	27.0	93 42.8	15.3	10 30.0	10.1	54.0
05	259 04.4	27.7	108 17.1	15.1	10 40.1	10.1	54.0
06	274 04.4	S16 28.4	122 51.2	15.2	N10 50.2	10.1	54.0
07	289 04.3	29.2	137 25.4	15.1	11 00.3	10.0	54.0
T 08	304 04.3	29.9	151 59.5	15.1	11 10.3	9.9	54.0
U 09	319 04.3	. . 30.6	166 33.6	15.1	11 20.2	10.0	54.0
E 10	334 04.2	31.3	181 07.7	15.0	11 30.2	9.8	54.0
S 11	349 04.2	32.1	195 41.7	15.0	11 40.0	9.9	54.0
D 12	4 04.1	S16 32.8	210 15.7	14.9	N11 49.9	9.8	54.0
A 13	19 04.1	33.5	224 49.6	14.9	11 59.7	9.7	54.0
Y 14	34 04.1	34.2	239 23.5	14.9	12 09.4	9.7	54.0
15	49 04.0	. . 35.0	253 57.4	14.8	12 19.1	9.6	54.0
16	64 04.0	35.7	268 31.2	14.8	12 28.7	9.6	54.0
17	79 03.9	36.4	283 05.0	14.8	12 38.3	9.5	54.0
18	94 03.9	S16 37.1	297 38.8	14.7	N12 47.8	9.5	54.0
19	109 03.8	37.9	312 12.5	14.7	12 57.3	9.5	54.0
20	124 03.8	38.6	326 46.2	14.6	13 06.8	9.3	54.0
21	139 03.8	. . 39.3	341 19.8	14.6	13 16.1	9.4	54.0
22	154 03.7	40.0	355 53.4	14.6	13 25.5	9.3	54.0
23	169 03.7	40.8	10 27.0	14.5	N13 34.8	9.2	54.0
	SD 16.2	d 0.7	SD 14.8		14.7		14.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 6	Moonrise 7	Moonrise 8	Moonrise 9
	h m	h m	h m	h m	h m	h m	h m
N 72	06 28	07 55	09 35	13 57	13 39	13 19	12 48
N 70	06 22	07 38	09 00	14 02	13 51	13 39	13 23
68	06 16	07 25	08 35	14 05	14 00	13 55	13 49
66	06 11	07 14	08 16	14 09	14 08	14 08	14 09
64	06 07	07 05	08 00	14 12	14 15	14 19	14 24
62	06 03	06 57	07 47	14 14	14 20	14 28	14 38
60	06 00	06 50	07 37	14 16	14 25	14 36	14 49
N 58	05 56	06 44	07 27	14 18	14 30	14 43	14 59
56	05 54	06 38	07 19	14 20	14 34	14 49	15 08
54	05 51	06 33	07 11	14 22	14 37	14 55	15 15
52	05 48	06 29	07 05	14 23	14 41	15 00	15 22
50	05 46	06 24	06 59	14 24	14 44	15 04	15 28
45	05 40	06 15	06 46	14 27	14 50	15 15	15 42
N 40	05 35	06 07	06 35	14 30	14 55	15 23	15 53
35	05 30	06 00	06 26	14 32	15 00	15 30	16 03
30	05 25	05 53	06 18	14 34	15 04	15 36	16 11
20	05 15	05 41	06 04	14 37	15 12	15 48	16 26
N 10	05 05	05 30	05 52	14 40	15 18	15 57	16 38
0	04 54	05 19	05 40	14 43	15 24	16 06	16 51
S 10	04 41	05 06	05 28	14 45	15 30	16 16	17 03
20	04 25	04 53	05 16	14 48	15 37	16 26	17 16
30	04 05	04 36	05 01	14 52	15 44	16 37	17 31
35	03 52	04 25	04 52	14 54	15 48	16 44	17 39
40	03 37	04 13	04 43	14 56	15 53	16 51	17 49
45	03 17	03 58	04 31	14 59	15 59	17 00	18 01
S 50	02 52	03 40	04 17	15 02	16 06	17 11	18 15
52	02 39	03 31	04 10	15 03	16 09	17 16	18 22
54	02 24	03 21	04 03	15 05	16 13	17 21	18 29
56	02 05	03 09	03 55	15 07	16 17	17 27	18 38
58	01 41	02 56	03 46	15 08	16 21	17 34	18 47
S 60	01 08	02 40	03 35	15 11	16 26	17 42	18 58

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 6	Moonset 7	Moonset 8	Moonset 9
°	h m	h m	h m	h m	h m	h m	h m
N 72	13 51	15 31	16 58	02 40	04 24	06 12	08 14
N 70	14 26	15 48	17 04	02 38	04 14	05 54	07 40
68	14 51	16 01	17 10	02 36	04 07	05 39	07 15
66	15 11	16 12	17 15	02 34	04 01	05 28	06 56
64	15 26	16 21	17 19	02 33	03 55	05 18	06 41
62	15 39	16 29	17 23	02 32	03 51	05 10	06 29
60	15 50	16 36	17 27	02 31	03 47	05 02	06 18
N 58	15 59	16 43	17 30	02 31	03 43	04 56	06 09
56	16 08	16 48	17 33	02 30	03 40	04 51	06 01
54	16 15	16 53	17 36	02 29	03 38	04 46	05 54
52	16 22	16 58	17 38	02 29	03 35	04 41	05 48
50	16 28	17 02	17 41	02 28	03 33	04 37	05 42
45	16 41	17 12	17 47	02 27	03 28	04 29	05 29
N 40	16 51	17 20	17 52	02 26	03 24	04 21	05 19
35	17 01	17 27	17 57	02 25	03 20	04 15	05 10
30	17 09	17 34	18 02	02 25	03 17	04 10	05 03
20	17 23	17 46	18 12	02 23	03 12	04 00	04 50
N 10	17 35	17 57	18 22	02 22	03 07	03 52	04 38
0	17 47	18 09	18 34	02 21	03 02	03 44	04 28
S 10	17 59	18 21	18 47	02 20	02 58	03 37	04 17
20	18 12	18 35	19 03	02 19	02 53	03 29	04 05
30	18 27	18 52	19 23	02 18	02 48	03 19	03 53
35	18 35	19 03	19 36	02 17	02 45	03 14	03 45
40	18 45	19 15	19 51	02 16	02 41	03 08	03 37
45	18 57	19 30	20 11	02 15	02 37	03 01	03 27
S 50	19 11	19 49	20 37	02 14	02 33	02 53	03 15
52	19 18	19 58	20 50	02 13	02 30	02 49	03 09
54	19 25	20 08	21 06	02 13	02 28	02 44	03 03
56	19 34	20 20	21 25	02 12	02 25	02 40	02 56
58	19 43	20 34	21 50	02 11	02 23	02 35	02 49
S 60	19 54	20 50	22 26	02 11	02 19	02 29	02 40

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
6	16 24	16 23	11 44	20 52	08 32	11	84
7	16 22	16 20	11 44	21 34	09 13	12	90
8	16 18	16 17	11 44	22 17	09 55	13	95

UT	ARIES	VENUS −3.8		MARS +1.0		JUPITER −2.9		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
9 00	47 49.5	161 26.4	S22 16.5	256 09.9	N13 30.0	15 44.2	N11 25.0	205 23.9	S 6 56.9
01	62 51.9	176 25.5	17.1	271 11.1	29.6	30 46.9	24.9	220 26.1	57.0
02	77 54.4	191 24.7	17.7	286 12.3	29.2	45 49.7	24.8	235 28.3	57.1
03	92 56.9	206 23.9	. . 18.3	301 13.6	. . 28.8	60 52.5	. . 24.7	250 30.5	. . 57.2
04	107 59.3	221 23.0	18.9	316 14.8	28.4	75 55.3	24.6	265 32.7	57.3
05	123 01.8	236 22.2	19.5	331 16.0	28.0	90 58.0	24.5	280 34.9	57.4
06	138 04.3	251 21.4	S22 20.1	346 17.2	N13 27.6	106 00.8	N11 24.4	295 37.1	S 6 57.5
W 07	153 06.7	266 20.5	20.7	1 18.4	27.2	121 03.6	24.3	310 39.3	57.6
E 08	168 09.2	281 19.7	21.3	16 19.7	26.8	136 06.4	24.2	325 41.5	57.7
D 09	183 11.7	296 18.9	. . 21.8	31 20.9	. . 26.4	151 09.1	. . 24.1	340 43.7	. . 57.8
N 10	198 14.1	311 18.0	22.4	46 22.1	26.0	166 11.9	24.0	355 45.9	57.9
E 11	213 16.6	326 17.2	23.0	61 23.3	25.6	181 14.7	23.9	10 48.1	58.0
S 12	228 19.1	341 16.4	S22 23.6	76 24.6	N13 25.2	196 17.5	N11 23.8	25 50.2	S 6 58.1
D 13	243 21.5	356 15.5	24.2	91 25.8	24.8	211 20.2	23.7	40 52.4	58.2
A 14	258 24.0	11 14.7	24.8	106 27.0	24.4	226 23.0	23.6	55 54.6	58.3
Y 15	273 26.4	26 13.8	. . 25.4	121 28.2	. . 24.0	241 25.8	. . 23.5	70 56.8	. . 58.4
16	288 28.9	41 13.0	25.9	136 29.4	23.6	256 28.6	23.4	85 59.0	58.5
17	303 31.4	56 12.2	26.5	151 30.7	23.2	271 31.3	23.3	101 01.2	58.6
18	318 33.8	71 11.3	S22 27.1	166 31.9	N13 22.8	286 34.1	N11 23.2	116 03.4	S 6 58.7
19	333 36.3	86 10.5	27.7	181 33.1	22.4	301 36.9	23.1	131 05.6	58.8
20	348 38.8	101 09.7	28.3	196 34.3	22.0	316 39.7	23.0	146 07.8	58.9
21	3 41.2	116 08.8	. . 28.8	211 35.6	. . 21.5	331 42.4	. . 22.9	161 10.0	. . 59.0
22	18 43.7	131 08.0	29.4	226 36.8	21.1	346 45.2	22.8	176 12.2	59.1
23	33 46.2	146 07.1	30.0	241 38.0	20.7	1 48.0	22.7	191 14.4	59.2
10 00	48 48.6	161 06.3	S22 30.6	256 39.3	N13 20.3	16 50.8	N11 22.6	206 16.6	S 6 59.3
01	63 51.1	176 05.4	31.1	271 40.5	19.9	31 53.5	22.5	221 18.8	59.4
02	78 53.6	191 04.6	31.7	286 41.7	19.5	46 56.3	22.4	236 20.9	59.5
03	93 56.0	206 03.8	. . 32.3	301 42.9	. . 19.1	61 59.1	. . 22.3	251 23.1	. . 59.6
04	108 58.5	221 02.9	32.8	316 44.2	18.7	77 01.9	22.2	266 25.3	59.7
05	124 00.9	236 02.1	33.4	331 45.4	18.3	92 04.6	22.1	281 27.5	59.8
06	139 03.4	251 01.2	S22 34.0	346 46.6	N13 17.9	107 07.4	N11 22.0	296 29.7	S 6 59.9
T 07	154 05.9	266 00.4	34.5	1 47.9	17.5	122 10.2	21.9	311 31.9	7 00.0
H 08	169 08.3	280 59.5	35.1	16 49.1	17.1	137 12.9	21.8	326 34.1	00.1
U 09	184 10.8	295 58.7	. . 35.7	31 50.3	. . 16.7	152 15.7	. . 21.6	341 36.3	. . 00.2
R 10	199 13.3	310 57.8	36.2	46 51.5	16.3	167 18.5	21.5	356 38.5	00.3
S 11	214 15.7	325 57.0	36.8	61 52.8	15.9	182 21.3	21.4	11 40.7	00.4
D 12	229 18.2	340 56.2	S22 37.4	76 54.0	N13 15.5	197 24.0	N11 21.3	26 42.9	S 7 00.5
A 13	244 20.7	355 55.3	37.9	91 55.2	15.1	212 26.8	21.2	41 45.1	00.6
Y 14	259 23.1	10 54.5	38.5	106 56.5	14.7	227 29.6	21.1	56 47.3	00.7
15	274 25.6	25 53.6	. . 39.0	121 57.7	. . 14.3	242 32.3	. . 21.0	71 49.5	. . 00.8
16	289 28.0	40 52.8	39.6	136 58.9	13.9	257 35.1	20.9	86 51.6	00.9
17	304 30.5	55 51.9	40.1	152 00.2	13.5	272 37.9	20.8	101 53.8	01.0
18	319 33.0	70 51.1	S22 40.7	167 01.4	N13 13.1	287 40.7	N11 20.7	116 56.0	S 7 01.1
19	334 35.4	85 50.2	41.2	182 02.6	12.7	302 43.4	20.6	131 58.2	01.2
20	349 37.9	100 49.4	41.8	197 03.9	12.3	317 46.2	20.5	147 00.4	01.4
21	4 40.4	115 48.5	. . 42.4	212 05.1	. . 11.9	332 49.0	. . 20.4	162 02.6	. . 01.5
22	19 42.8	130 47.7	42.9	227 06.3	11.5	347 51.7	20.3	177 04.8	01.6
23	34 45.3	145 46.8	43.4	242 07.6	11.1	2 54.5	20.2	192 07.0	01.7
11 00	49 47.8	160 46.0	S22 44.0	257 08.8	N13 10.7	17 57.3	N11 20.1	207 09.2	S 7 01.8
01	64 50.2	175 45.1	44.5	272 10.0	10.3	33 00.1	20.0	222 11.4	01.9
02	79 52.7	190 44.3	45.1	287 11.3	09.9	48 02.8	19.9	237 13.6	02.0
03	94 55.2	205 43.4	. . 45.6	302 12.5	. . 09.4	63 05.6	. . 19.8	252 15.8	. . 02.1
04	109 57.6	220 42.5	46.2	317 13.8	09.0	78 08.4	19.7	267 18.0	02.2
05	125 00.1	235 41.7	46.7	332 15.0	08.6	93 11.1	19.6	282 20.2	02.3
06	140 02.5	250 40.8	S22 47.2	347 16.2	N13 08.2	108 13.9	N11 19.5	297 22.4	S 7 02.4
07	155 05.0	265 40.0	47.8	2 17.5	07.8	123 16.7	19.4	312 24.6	02.5
08	170 07.5	280 39.1	48.3	17 18.7	07.4	138 19.4	19.3	327 26.8	02.6
F 09	185 09.9	295 38.3	. . 48.9	32 19.9	. . 07.0	153 22.2	. . 19.2	342 28.9	. . 02.7
R 10	200 12.4	310 37.4	49.4	47 21.2	06.6	168 25.0	19.1	357 31.1	02.8
I 11	215 14.9	325 36.6	49.9	62 22.4	06.2	183 27.7	19.0	12 33.3	02.9
D 12	230 17.3	340 35.7	S22 50.5	77 23.7	N13 05.8	198 30.5	N11 18.9	27 35.5	S 7 03.0
A 13	245 19.8	355 34.8	51.0	92 24.9	05.4	213 33.3	18.8	42 37.7	03.1
Y 14	260 22.3	10 34.0	51.5	107 26.1	05.0	228 36.1	18.7	57 39.9	03.2
15	275 24.7	25 33.1	. . 52.1	122 27.4	. . 04.6	243 38.8	. . 18.6	72 42.1	. . 03.3
16	290 27.2	40 32.3	52.6	137 28.6	04.2	258 41.6	18.5	87 44.3	03.4
17	305 29.7	55 31.4	53.1	152 29.9	03.8	273 44.4	18.4	102 46.5	03.5
18	320 32.1	70 30.6	S22 53.6	167 31.1	N13 03.4	288 47.1	N11 18.3	117 48.7	S 7 03.6
19	335 34.6	85 29.7	54.2	182 32.4	03.0	303 49.9	18.2	132 50.9	03.7
20	350 37.0	100 28.8	54.7	197 33.6	02.6	318 52.7	18.1	147 53.1	03.8
21	5 39.5	115 28.0	. . 55.2	212 34.8	. . 02.2	333 55.4	. . 18.0	162 55.3	. . 03.9
22	20 42.0	130 27.1	55.7	227 36.1	01.8	348 58.2	17.9	177 57.5	04.0
23	35 44.4	145 26.2	56.2	242 37.3	01.4	4 01.0	17.8	192 59.7	04.1
	h m								
Mer. Pass.	20 41.4	v −0.8	d 0.6	v 1.2	d 0.4	v 2.8	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.4
Achernar	335 27.0	S57 10.6
Acrux	173 11.2	S63 09.7
Adhara	255 13.2	S28 59.2
Aldebaran	290 50.4	N16 32.0
Alioth	166 22.1	N55 53.5
Alkaid	153 00.2	N49 15.1
Al Na'ir	27 45.0	S46 54.3
Alnilam	275 47.3	S 1 11.6
Alphard	217 57.2	S 8 42.6
Alphecca	126 12.3	N26 40.6
Alpheratz	357 44.5	N29 09.7
Altair	62 09.5	N 8 54.2
Ankaa	353 16.5	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.3
Atria	107 31.4	S69 02.9
Avior	234 18.4	S59 32.6
Bellatrix	278 33.0	N 6 21.6
Betelgeuse	271 02.3	N 7 24.5
Canopus	263 56.3	S52 42.0
Capella	280 35.7	N46 00.5
Deneb	49 32.4	N45 19.8
Denebola	182 35.0	N14 30.3
Diphda	348 56.8	S17 55.2
Dubhe	193 53.3	N61 40.9
Elnath	278 13.7	N28 37.0
Eltanin	90 47.1	N51 29.5
Enif	33 48.2	N 9 56.0
Fomalhaut	15 25.1	S29 33.5
Gacrux	172 02.7	S57 10.6
Gienah	175 53.7	S17 36.4
Hadar	148 50.2	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.1	N74 06.4
Markab	13 39.3	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.3	S36 25.6
Miaplacidus	221 39.9	S69 45.7
Mirfak	308 41.5	N49 54.2
Nunki	75 59.9	S26 16.8
Peacock	53 21.2	S56 41.9
Pollux	243 29.0	N27 59.7
Procyon	245 00.8	N 5 11.6
Rasalhague	96 07.8	N12 33.3
Regulus	207 44.8	N11 54.4
Rigel	281 12.9	S 8 11.2
Rigil Kent.	139 54.0	S60 52.9
Sabik	102 14.2	S15 44.3
Schedar	349 41.4	N56 36.5
Shaula	96 23.8	S37 06.7
Sirius	258 34.5	S16 43.9
Spica	158 32.8	S11 13.3
Suhail	222 53.3	S43 28.7
Vega	80 40.0	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	112 17.7	13 16
Mars	207 50.6	6 53
Jupiter	328 02.1	22 48
Saturn	157 27.9	10 13

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
9 00	184 03.6	S16 41.5	25 00.5	14.5	N13 44.0	9.1	54.0
01	199 03.6	42.2	39 34.0	14.4	13 53.1	9.1	54.0
02	214 03.5	42.9	54 07.4	14.4	14 02.2	9.1	54.0
03	229 03.5	. . 43.6	68 40.8	14.4	14 11.3	9.0	54.0
04	244 03.4	44.4	83 14.2	14.3	14 20.3	8.9	54.0
05	259 03.4	45.1	97 47.5	14.2	14 29.2	8.9	54.0
06	274 03.3	S16 45.8	112 20.7	14.3	N14 38.1	8.8	54.0
W 07	289 03.3	46.5	126 54.0	14.1	14 46.9	8.8	54.0
E 08	304 03.2	47.2	141 27.1	14.2	14 55.7	8.7	54.0
D 09	319 03.2	. . 47.9	156 00.3	14.0	15 04.4	8.6	54.0
N 10	334 03.1	48.7	170 33.3	14.1	15 13.0	8.6	54.0
E 11	349 03.1	49.4	185 06.4	14.0	15 21.6	8.5	54.0
S 12	4 03.0	S16 50.1	199 39.4	13.9	N15 30.1	8.5	54.0
D 13	19 03.0	50.8	214 12.3	13.9	15 38.6	8.3	54.0
A 14	34 02.9	51.5	228 45.2	13.9	15 46.9	8.4	54.0
Y 15	49 02.9	. . 52.2	243 18.1	13.8	15 55.3	8.2	54.0
16	64 02.8	53.0	257 50.9	13.8	16 03.5	8.2	54.0
17	79 02.8	53.7	272 23.7	13.7	16 11.7	8.1	54.0
18	94 02.7	S16 54.4	286 56.4	13.6	N16 19.8	8.1	54.1
19	109 02.7	55.1	301 29.0	13.7	16 27.9	7.9	54.1
20	124 02.6	55.8	316 01.7	13.5	16 35.8	7.9	54.1
21	139 02.6	. . 56.5	330 34.2	13.6	16 43.7	7.9	54.1
22	154 02.5	57.2	345 06.8	13.4	16 51.6	7.8	54.1
23	169 02.5	57.9	359 39.2	13.5	16 59.4	7.7	54.1
10 00	184 02.4	S16 58.6	14 11.7	13.3	N17 07.1	7.6	54.1
01	199 02.4	16 59.3	28 44.0	13.4	17 14.7	7.5	54.1
02	214 02.3	17 00.1	43 16.4	13.3	17 22.2	7.5	54.1
03	229 02.3	. . 00.8	57 48.7	13.2	17 29.7	7.4	54.1
04	244 02.2	01.5	72 20.9	13.2	17 37.1	7.3	54.1
05	259 02.1	02.2	86 53.1	13.1	17 44.4	7.3	54.1
06	274 02.1	S17 02.9	101 25.2	13.1	N17 51.7	7.2	54.1
T 07	289 02.0	03.6	115 57.3	13.0	17 58.9	7.1	54.1
H 08	304 02.0	04.3	130 29.3	13.0	18 06.0	7.0	54.1
U 09	319 01.9	. . 05.0	145 01.3	13.0	18 13.0	6.9	54.1
R 10	334 01.9	05.7	159 33.3	12.9	18 19.9	6.9	54.1
S 11	349 01.8	06.4	174 05.2	12.8	18 26.8	6.8	54.2
D 12	4 01.7	S17 07.1	188 37.0	12.8	N18 33.6	6.7	54.2
A 13	19 01.7	07.8	203 08.8	12.7	18 40.3	6.6	54.2
Y 14	34 01.6	08.5	217 40.5	12.7	18 46.9	6.6	54.2
15	49 01.6	. . 09.2	232 12.2	12.7	18 53.5	6.4	54.2
16	64 01.5	09.9	246 43.9	12.6	18 59.9	6.4	54.2
17	79 01.4	10.6	261 15.5	12.5	19 06.3	6.3	54.2
18	94 01.4	S17 11.3	275 47.0	12.5	N19 12.6	6.2	54.2
19	109 01.3	12.0	290 18.5	12.5	19 18.8	6.1	54.2
20	124 01.3	12.7	304 50.0	12.4	19 24.9	6.0	54.2
21	139 01.2	. . 13.4	319 21.4	12.4	19 30.9	6.0	54.2
22	154 01.1	14.1	333 52.8	12.3	19 36.9	5.8	54.2
23	169 01.1	14.8	348 24.1	12.2	19 42.7	5.8	54.2
11 00	184 01.0	S17 15.5	2 55.3	12.2	N19 48.5	5.7	54.3
01	199 00.9	16.2	17 26.5	12.2	19 54.2	5.6	54.3
02	214 00.9	16.9	31 57.7	12.1	19 59.8	5.5	54.3
03	229 00.8	. . 17.6	46 28.8	12.1	20 05.3	5.4	54.3
04	244 00.8	18.3	60 59.9	12.0	20 10.7	5.3	54.3
05	259 00.7	19.0	75 30.9	12.0	20 16.0	5.2	54.3
06	274 00.6	S17 19.7	90 01.9	11.9	N20 21.2	5.2	54.3
07	289 00.6	20.4	104 32.8	11.9	20 26.4	5.0	54.3
08	304 00.5	21.1	119 03.7	11.9	20 31.4	4.9	54.3
F 09	319 00.4	. . 21.8	133 34.6	11.8	20 36.3	4.9	54.3
R 10	334 00.4	22.5	148 05.4	11.7	20 41.2	4.8	54.4
I 11	349 00.3	23.1	162 36.1	11.7	20 46.0	4.6	54.4
D 12	4 00.2	S17 23.8	177 06.8	11.7	N20 50.6	4.6	54.4
A 13	19 00.2	24.5	191 37.5	11.6	20 55.2	4.5	54.4
Y 14	34 00.1	25.2	206 08.1	11.6	20 59.7	4.3	54.4
15	49 00.0	. . 25.9	220 38.7	11.5	21 04.0	4.3	54.4
16	64 00.0	26.6	235 09.2	11.5	21 08.3	4.2	54.4
17	78 59.9	27.3	249 39.7	11.4	21 12.5	4.0	54.4
18	93 59.8	S17 28.0	264 10.1	11.5	N21 16.5	4.0	54.4
19	108 59.7	28.7	278 40.6	11.3	21 20.5	3.9	54.4
20	123 59.7	29.3	293 10.9	11.4	21 24.4	3.8	54.5
21	138 59.6	. . 30.0	307 41.3	11.2	21 28.2	3.7	54.5
22	153 59.5	30.7	322 11.5	11.3	21 31.9	3.5	54.5
23	168 59.5	31.4	336 41.8	11.2	N21 35.4	3.5	54.5
	SD 16.2	d 0.7	SD 14.7		14.8		14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 9	Moonrise 10	Moonrise 11	Moonrise 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 40	08 09	09 59	12 48			
N 70	06 32	07 50	09 16	13 23	12 58		
68	06 25	07 35	08 48	13 49	13 42	13 32	
66	06 19	07 23	08 27	14 09	14 12	14 19	14 39
64	06 14	07 13	08 10	14 24	14 34	14 50	15 18
62	06 10	07 04	07 56	14 38	14 52	15 13	15 46
60	06 06	06 57	07 44	14 49	15 07	15 32	16 07
N 58	06 02	06 50	07 34	14 59	15 20	15 47	16 25
56	05 59	06 44	07 25	15 08	15 31	16 00	16 39
54	05 56	06 39	07 17	15 15	15 40	16 12	16 52
52	05 53	06 34	07 10	15 22	15 49	16 22	17 03
50	05 50	06 29	07 04	15 28	15 57	16 31	17 13
45	05 44	06 19	06 50	15 42	16 13	16 50	17 34
N 40	05 38	06 10	06 39	15 53	16 27	17 06	17 51
35	05 32	06 03	06 29	16 03	16 39	17 19	18 05
30	05 27	05 56	06 21	16 11	16 49	17 31	18 17
20	05 16	05 43	06 06	16 26	17 07	17 51	18 39
N 10	05 05	05 31	05 53	16 38	17 22	18 08	18 57
0	04 54	05 19	05 40	16 51	17 37	18 25	19 14
S 10	04 40	05 06	05 28	17 03	17 51	18 41	19 32
20	04 24	04 51	05 15	17 16	18 07	18 58	19 50
30	04 03	04 33	04 59	17 31	18 25	19 19	20 11
35	03 49	04 22	04 50	17 39	18 35	19 30	20 24
40	03 33	04 10	04 40	17 49	18 47	19 44	20 38
45	03 12	03 54	04 27	18 01	19 01	20 00	20 56
S 50	02 45	03 35	04 12	18 15	19 19	20 20	21 17
52	02 31	03 25	04 05	18 22	19 27	20 30	21 27
54	02 15	03 14	03 58	18 29	19 36	20 40	21 38
56	01 54	03 02	03 49	18 38	19 47	20 52	21 51
58	01 28	02 47	03 39	18 47	19 59	21 07	22 07
S 60	00 46	02 30	03 27	18 58	20 13	21 23	22 25

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 9	Moonset 10	Moonset 11	Moonset 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	13 27	15 18	16 47	08 14			
N 70	14 10	15 36	16 55	07 40	09 40		
68	14 39	15 51	17 01	07 15	08 56	10 45	
66	15 00	16 03	17 07	06 56	08 27	09 58	11 21
64	15 17	16 14	17 12	06 41	08 06	09 27	10 41
62	15 31	16 22	17 17	06 29	07 48	09 05	10 14
60	15 43	16 30	17 21	06 18	07 34	08 47	09 53
N 58	15 53	16 37	17 25	06 09	07 22	08 31	09 36
56	16 02	16 43	17 28	06 01	07 11	08 19	09 21
54	16 10	16 49	17 31	05 54	07 02	08 07	09 09
52	16 17	16 54	17 34	05 48	06 53	07 57	08 58
50	16 23	16 58	17 37	05 42	06 46	07 49	08 48
45	16 37	17 08	17 44	05 29	06 30	07 30	08 27
N 40	16 48	17 17	17 50	05 19	06 17	07 15	08 10
35	16 58	17 25	17 55	05 10	06 06	07 02	07 56
30	17 07	17 32	18 01	05 03	05 57	06 51	07 44
20	17 22	17 45	18 11	04 50	05 40	06 32	07 23
N 10	17 35	17 57	18 22	04 38	05 26	06 15	07 05
0	17 47	18 09	18 34	04 28	05 12	05 59	06 48
S 10	18 00	18 22	18 48	04 17	04 59	05 44	06 31
20	18 14	18 37	19 04	04 05	04 45	05 27	06 13
30	18 29	18 55	19 26	03 53	04 29	05 08	05 53
35	18 38	19 06	19 39	03 45	04 19	04 57	05 40
40	18 49	19 19	19 56	03 37	04 08	04 45	05 26
45	19 01	19 35	20 16	03 27	03 56	04 30	05 10
S 50	19 16	19 54	20 44	03 15	03 41	04 12	04 50
52	19 24	20 04	20 58	03 09	03 34	04 03	04 40
54	19 31	20 15	21 15	03 03	03 26	03 54	04 29
56	19 40	20 28	21 36	02 56	03 17	03 43	04 17
58	19 50	20 42	22 04	02 49	03 07	03 30	04 02
S 60	20 02	21 00	22 51	02 40	02 55	03 16	03 46

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
9	16 15	16 12	11 44	23 01	10 39	14	98
10	16 10	16 07	11 44	23 48	11 24	15	100
11	16 04	16 01	11 44	24 36	12 12	16	100

UT	ARIES	VENUS −3.8		MARS +1.0		JUPITER −2.9		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
12 00	50 46.9	160 25.4	S22 56.8	257 38.6	N13 01.0	19 03.7	N11 17.7	208 01.9	S 7 04.2
01	65 49.4	175 24.5	57.3	272 39.8	00.6	34 06.5	17.6	223 04.1	04.3
02	80 51.8	190 23.7	57.8	287 41.1	13 00.2	49 09.3	17.5	238 06.3	04.4
03	95 54.3	205 22.8 . .	58.3	302 42.3	12 59.8	64 12.0 . .	17.4	253 08.5 . .	04.5
04	110 56.8	220 21.9	58.8	317 43.5	59.4	79 14.8	17.3	268 10.6	04.6
05	125 59.2	235 21.1	59.3	332 44.8	59.0	94 17.6	17.2	283 12.8	04.7
06	141 01.7	250 20.2	S22 59.9	347 46.0	N12 58.6	109 20.3	N11 17.1	298 15.0	S 7 04.8
07	156 04.2	265 19.3	23 00.4	2 47.3	58.2	124 23.1	17.0	313 17.2	04.9
S 08	171 06.6	280 18.5	00.9	17 48.5	57.8	139 25.9	16.9	328 19.4	05.0
A 09	186 09.1	295 17.6 . .	01.4	32 49.8 . .	57.4	154 28.6 . .	16.8	343 21.6 . .	05.1
T 10	201 11.5	310 16.7	01.9	47 51.0	57.0	169 31.4	16.7	358 23.8	05.2
U 11	216 14.0	325 15.9	02.4	62 52.3	56.6	184 34.2	16.6	13 26.0	05.3
R 12	231 16.5	340 15.0	S23 02.9	77 53.5	N12 56.2	199 36.9	N11 16.5	28 28.2	S 7 05.4
D 13	246 18.9	355 14.1	03.4	92 54.8	55.8	214 39.7	16.4	43 30.4	05.5
A 14	261 21.4	10 13.3	03.9	107 56.0	55.4	229 42.5	16.3	58 32.6	05.6
Y 15	276 23.9	25 12.4 . .	04.4	122 57.3 . .	55.0	244 45.2 . .	16.2	73 34.8 . .	05.7
16	291 26.3	40 11.5	04.9	137 58.5	54.6	259 48.0	16.1	88 37.0	05.8
17	306 28.8	55 10.7	05.4	152 59.8	54.2	274 50.7	16.0	103 39.2	05.9
18	321 31.3	70 09.8	S23 05.9	168 01.0	N12 53.8	289 53.5	N11 15.9	118 41.4	S 7 06.0
19	336 33.7	85 08.9	06.4	183 02.3	53.4	304 56.3	15.8	133 43.6	06.1
20	351 36.2	100 08.1	06.9	198 03.5	53.0	319 59.0	15.8	148 45.8	06.2
21	6 38.6	115 07.2 . .	07.4	213 04.8 . .	52.6	335 01.8 . .	15.7	163 48.0 . .	06.3
22	21 41.1	130 06.3	07.9	228 06.0	52.2	350 04.6	15.6	178 50.2	06.4
23	36 43.6	145 05.4	08.4	243 07.3	51.8	5 07.3	15.5	193 52.4	06.5
13 00	51 46.0	160 04.6	S23 08.9	258 08.5	N12 51.4	20 10.1	N11 15.4	208 54.6	S 7 06.6
01	66 48.5	175 03.7	09.4	273 09.8	51.0	35 12.9	15.3	223 56.8	06.7
02	81 51.0	190 02.8	09.9	288 11.0	50.6	50 15.6	15.2	238 59.0	06.8
03	96 53.4	205 02.0 . .	10.3	303 12.3 . .	50.2	65 18.4 . .	15.1	254 01.2 . .	06.9
04	111 55.9	220 01.1	10.8	318 13.5	49.8	80 21.1	15.0	269 03.4	07.0
05	126 58.4	235 00.2	11.3	333 14.8	49.4	95 23.9	14.9	284 05.5	07.1
06	142 00.8	249 59.3	S23 11.8	348 16.0	N12 49.0	110 26.7	N11 14.8	299 07.7	S 7 07.2
07	157 03.3	264 58.5	12.3	3 17.3	48.6	125 29.4	14.7	314 09.9	07.3
08	172 05.8	279 57.6	12.8	18 18.6	48.2	140 32.2	14.6	329 12.1	07.4
S 09	187 08.2	294 56.7 . .	13.2	33 19.8 . .	47.8	155 35.0 . .	14.5	344 14.3 . .	07.5
U 10	202 10.7	309 55.8	13.7	48 21.1	47.4	170 37.7	14.4	359 16.5	07.6
N 11	217 13.1	324 55.0	14.2	63 22.3	47.0	185 40.5	14.3	14 18.7	07.7
D 12	232 15.6	339 54.1	S23 14.7	78 23.6	N12 46.6	200 43.2	N11 14.2	29 20.9	S 7 07.8
A 13	247 18.1	354 53.2	15.2	93 24.8	46.1	215 46.0	14.1	44 23.1	07.9
Y 14	262 20.5	9 52.3	15.6	108 26.1	45.7	230 48.8	14.0	59 25.3	08.0
15	277 23.0	24 51.5 . .	16.1	123 27.4 . .	45.3	245 51.5 . .	13.9	74 27.5 . .	08.1
16	292 25.5	39 50.6	16.6	138 28.6	44.9	260 54.3	13.8	89 29.7	08.2
17	307 27.9	54 49.7	17.0	153 29.9	44.5	275 57.0	13.7	104 31.9	08.3
18	322 30.4	69 48.8	S23 17.5	168 31.1	N12 44.1	290 59.8	N11 13.6	119 34.1	S 7 08.4
19	337 32.9	84 47.9	18.0	183 32.4	43.7	306 02.6	13.5	134 36.3	08.5
20	352 35.3	99 47.1	18.5	198 33.7	43.3	321 05.3	13.4	149 38.5	08.6
21	7 37.8	114 46.2 . .	18.9	213 34.9 . .	42.9	336 08.1 . .	13.3	164 40.7 . .	08.7
22	22 40.3	129 45.3	19.4	228 36.2	42.5	351 10.8	13.2	179 42.9	08.8
23	37 42.7	144 44.4	19.8	243 37.4	42.1	6 13.6	13.1	194 45.1	08.9
14 00	52 45.2	159 43.5	S23 20.3	258 38.7	N12 41.7	21 16.4	N11 13.0	209 47.3	S 7 09.0
01	67 47.6	174 42.7	20.8	273 40.0	41.3	36 19.1	12.9	224 49.5	09.1
02	82 50.1	189 41.8	21.2	288 41.2	40.9	51 21.9	12.8	239 51.7	09.2
03	97 52.6	204 40.9 . .	21.7	303 42.5 . .	40.5	66 24.6 . .	12.7	254 53.9 . .	09.3
04	112 55.0	219 40.0	22.1	318 43.7	40.1	81 27.4	12.6	269 56.1	09.4
05	127 57.5	234 39.1	22.6	333 45.0	39.8	96 30.2	12.5	284 58.3	09.5
06	143 00.0	249 38.2	S23 23.1	348 46.3	N12 39.4	111 32.9	N11 12.4	300 00.5	S 7 09.6
07	158 02.4	264 37.4	23.5	3 47.5	39.0	126 35.7	12.3	315 02.7	09.7
08	173 04.9	279 36.5	24.0	18 48.8	38.6	141 38.4	12.3	330 04.9	09.8
M 09	188 07.4	294 35.6 . .	24.4	33 50.1 . .	38.2	156 41.2 . .	12.2	345 07.1 . .	09.9
O 10	203 09.8	309 34.7	24.9	48 51.3	37.8	171 44.0	12.1	0 09.3	10.0
N 11	218 12.3	324 33.8	25.3	63 52.6	37.4	186 46.7	12.0	15 11.5	10.1
D 12	233 14.8	339 32.9	S23 25.8	78 53.9	N12 37.0	201 49.5	N11 11.9	30 13.7	S 7 10.2
A 13	248 17.2	354 32.1	26.2	93 55.1	36.6	216 52.2	11.8	45 15.9	10.3
Y 14	263 19.7	9 31.2	26.7	108 56.4	36.2	231 55.0	11.7	60 18.1	10.4
15	278 22.1	24 30.3 . .	27.1	123 57.7 . .	35.8	246 57.7 . .	11.6	75 20.3 . .	10.5
16	293 24.6	39 29.4	27.6	138 58.9	35.4	262 00.5	11.5	90 22.5	10.6
17	308 27.1	54 28.5	28.0	154 00.2	35.0	277 03.3	11.4	105 24.7	10.7
18	323 29.5	69 27.6	S23 28.4	169 01.5	N12 34.6	292 06.0	N11 11.3	120 26.9	S 7 10.8
19	338 32.0	84 26.7	28.9	184 02.7	34.2	307 08.8	11.2	135 29.1	10.9
20	353 34.5	99 25.8	29.3	199 04.0	33.8	322 11.5	11.1	150 31.3	11.0
21	8 36.9	114 25.0 . .	29.8	214 05.3 . .	33.4	337 14.3 . .	11.0	165 33.5 . .	11.1
22	23 39.4	129 24.1	30.2	229 06.5	33.0	352 17.0	10.9	180 35.7	11.2
23	38 41.9	144 23.2	30.6	244 07.8	32.6	7 19.8	10.8	195 37.8	11.3
	h m								
Mer. Pass.	20 29.6	*v* −0.9	*d* 0.5	*v* 1.3	*d* 0.4	*v* 2.8	*d* 0.1	*v* 2.2	*d* 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.4
Achernar	335 27.0	S57 10.6
Acrux	173 11.1	S63 09.7
Adhara	255 13.2	S28 59.2
Aldebaran	290 50.4	N16 32.0
Alioth	166 22.1	N55 53.5
Alkaid	153 00.2	N49 15.1
Al Na'ir	27 45.0	S46 54.3
Alnilam	275 47.2	S 1 11.7
Alphard	217 57.2	S 8 42.6
Alphecca	126 12.3	N26 40.6
Alpheratz	357 44.5	N29 09.7
Altair	62 09.5	N 8 54.2
Ankaa	353 16.5	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.2
Atria	107 31.4	S69 02.9
Avior	234 18.3	S59 32.6
Bellatrix	278 32.9	N 6 21.6
Betelgeuse	271 02.3	N 7 24.5
Canopus	263 56.3	S52 42.0
Capella	280 35.7	N46 00.5
Deneb	49 32.4	N45 19.8
Denebola	182 35.0	N14 30.3
Diphda	348 56.8	S17 55.2
Dubhe	193 53.3	N61 40.9
Elnath	278 13.7	N28 37.0
Eltanin	90 47.1	N51 29.5
Enif	33 48.2	N 9 56.0
Fomalhaut	15 25.1	S29 33.5
Gacrux	172 02.6	S57 10.6
Gienah	175 53.7	S17 36.4
Hadar	148 50.2	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.1	N74 06.3
Markab	13 39.3	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.3	S36 25.6
Miaplacidus	221 39.9	S69 45.7
Mirfak	308 41.5	N49 54.2
Nunki	76 00.0	S26 16.8
Peacock	53 21.2	S56 41.9
Pollux	243 28.9	N27 59.7
Procyon	245 00.8	N 5 11.6
Rasalhague	96 07.8	N12 33.3
Regulus	207 44.8	N11 54.4
Rigel	281 12.8	S 8 11.2
Rigil Kent.	139 54.0	S60 52.9
Sabik	102 14.2	S15 44.3
Schedar	349 41.4	N56 36.5
Shaula	96 23.8	S37 06.7
Sirius	258 34.5	S16 43.9
Spica	158 32.7	S11 13.3
Suhail	222 53.3	S43 28.7
Vega	80 40.0	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	108 18.5	13 20
Mars	206 22.5	6 47
Jupiter	328 24.1	22 35
Saturn	157 08.5	10 03

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
12 00	183 59.4	S17 32.1	351 12.0	11.2	N21 38.9	3.4	54.5
01	198 59.3	32.8	5 42.2	11.1	21 42.3	3.2	54.5
02	213 59.2	33.5	20 12.3	11.1	21 45.5	3.2	54.5
03	228 59.2	. . 34.1	34 42.4	11.1	21 48.7	3.0	54.5
04	243 59.1	34.8	49 12.5	11.0	21 51.7	3.0	54.6
05	258 59.0	35.5	63 42.5	11.0	21 54.7	2.8	54.6
06	273 59.0	S17 36.2	78 12.5	10.9	N21 57.5	2.8	54.6
07	288 58.9	36.9	92 42.4	10.9	22 00.3	2.6	54.6
S 08	303 58.8	37.5	107 12.3	10.9	22 02.9	2.5	54.6
A 09	318 58.7	. . 38.2	121 42.2	10.9	22 05.4	2.5	54.6
T 10	333 58.7	38.9	136 12.1	10.8	22 07.9	2.3	54.6
U 11	348 58.6	39.6	150 41.9	10.8	22 10.2	2.2	54.6
R 12	3 58.5	S17 40.3	165 11.7	10.7	N22 12.4	2.1	54.7
D 13	18 58.4	40.9	179 41.4	10.7	22 14.5	2.0	54.7
A 14	33 58.3	41.6	194 11.1	10.7	22 16.5	1.9	54.7
Y 15	48 58.3	. . 42.3	208 40.8	10.7	22 18.4	1.7	54.7
16	63 58.2	43.0	223 10.5	10.6	22 20.1	1.7	54.7
17	78 58.1	43.6	237 40.1	10.7	22 21.8	1.6	54.7
18	93 58.0	S17 44.3	252 09.8	10.5	N22 23.4	1.4	54.7
19	108 58.0	45.0	266 39.3	10.6	22 24.8	1.3	54.8
20	123 57.9	45.7	281 08.9	10.5	22 26.1	1.3	54.8
21	138 57.8	. . 46.3	295 38.4	10.5	22 27.4	1.1	54.8
22	153 57.7	47.0	310 07.9	10.5	22 28.5	1.0	54.8
23	168 57.6	47.7	324 37.4	10.5	22 29.5	0.9	54.8
13 00	183 57.6	S17 48.4	339 06.9	10.4	N22 30.4	0.7	54.8
01	198 57.5	49.0	353 36.3	10.4	22 31.1	0.7	54.8
02	213 57.4	49.7	8 05.7	10.4	22 31.8	0.5	54.9
03	228 57.3	. . 50.4	22 35.1	10.4	22 32.3	0.5	54.9
04	243 57.2	51.0	37 04.5	10.4	22 32.8	0.3	54.9
05	258 57.2	51.7	51 33.9	10.3	22 33.1	0.2	54.9
06	273 57.1	S17 52.4	66 03.2	10.3	N22 33.3	0.1	54.9
07	288 57.0	53.0	80 32.5	10.3	22 33.4	0.0	54.9
08	303 56.9	53.7	95 01.8	10.3	22 33.4	0.1	55.0
S 09	318 56.8	. . 54.4	109 31.1	10.3	22 33.3	0.3	55.0
U 10	333 56.7	55.0	124 00.4	10.2	22 33.0	0.3	55.0
N 11	348 56.6	55.7	138 29.6	10.3	22 32.7	0.5	55.0
D 12	3 56.6	S17 56.4	152 58.9	10.2	N22 32.2	0.6	55.0
A 13	18 56.5	57.0	167 28.1	10.2	22 31.6	0.7	55.0
Y 14	33 56.4	57.7	181 57.3	10.2	22 30.9	0.8	55.1
15	48 56.3	. . 58.4	196 26.5	10.2	22 30.1	0.9	55.1
16	63 56.2	59.0	210 55.7	10.2	22 29.2	1.0	55.1
17	78 56.1	17 59.7	225 24.9	10.2	22 28.2	1.2	55.1
18	93 56.0	S18 00.4	239 54.1	10.1	N22 27.0	1.3	55.1
19	108 56.0	01.0	254 23.2	10.2	22 25.7	1.4	55.1
20	123 55.9	01.7	268 52.4	10.1	22 24.3	1.5	55.2
21	138 55.8	. . 02.3	283 21.5	10.2	22 22.8	1.6	55.2
22	153 55.7	03.0	297 50.7	10.1	22 21.2	1.7	55.2
23	168 55.6	03.7	312 19.8	10.2	22 19.5	1.8	55.2
14 00	183 55.5	S18 04.3	326 49.0	10.1	N22 17.7	2.0	55.2
01	198 55.4	05.0	341 18.1	10.1	22 15.7	2.1	55.2
02	213 55.3	05.6	355 47.2	10.1	22 13.6	2.2	55.3
03	228 55.2	. . 06.3	10 16.3	10.2	22 11.4	2.3	55.3
04	243 55.2	07.0	24 45.5	10.1	22 09.1	2.4	55.3
05	258 55.1	07.6	39 14.6	10.1	22 06.7	2.5	55.3
06	273 55.0	S18 08.3	53 43.7	10.1	N22 04.2	2.7	55.3
07	288 54.9	08.9	68 12.8	10.1	22 01.5	2.7	55.4
08	303 54.8	09.6	82 41.9	10.2	21 58.8	2.9	55.4
M 09	318 54.7	. . 10.2	97 11.1	10.1	21 55.9	3.0	55.4
O 10	333 54.6	10.9	111 40.2	10.1	21 52.9	3.1	55.4
N 11	348 54.5	11.5	126 09.3	10.2	21 49.8	3.2	55.4
D 12	3 54.4	S18 12.2	140 38.5	10.1	N21 46.6	3.3	55.5
A 13	18 54.3	12.8	155 07.6	10.1	21 43.3	3.5	55.5
Y 14	33 54.2	13.5	169 36.7	10.2	21 39.8	3.5	55.5
15	48 54.1	. . 14.1	184 05.9	10.1	21 36.3	3.7	55.5
16	63 54.0	14.8	198 35.0	10.2	21 32.6	3.8	55.5
17	78 53.9	15.4	213 04.2	10.2	21 28.8	3.9	55.6
18	93 53.8	S18 16.1	227 33.4	10.2	N21 24.9	4.0	55.6
19	108 53.7	16.7	242 02.6	10.1	21 20.9	4.1	55.6
20	123 53.6	17.4	256 31.7	10.2	21 16.8	4.2	55.6
21	138 53.5	. . 18.0	271 00.9	10.2	21 12.6	4.4	55.6
22	153 53.4	18.7	285 30.1	10.3	21 08.2	4.4	55.7
23	168 53.3	19.3	299 59.4	10.2	N21 03.8	4.6	55.7
	SD 16.2	d 0.7	SD 14.9		15.0		15.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 12	Moonrise 13	Moonrise 14	Moonrise 15
°	h m	h m	h m	h m	h m	h m	h m
N 72	06 51	08 23	10 29				
N 70	06 42	08 02	09 34				16 37
68	06 34	07 46	09 02			15 38	17 39
66	06 27	07 32	08 38	14 39	15 24	16 41	18 14
64	06 22	07 21	08 20	15 18	16 06	17 15	18 39
62	06 17	07 12	08 05	15 46	16 35	17 40	18 59
60	06 12	07 04	07 52	16 07	16 56	18 00	19 14
N 58	06 08	06 56	07 41	16 25	17 14	18 16	19 28
56	06 04	06 50	07 31	16 39	17 29	18 30	19 39
54	06 01	06 44	07 23	16 52	17 42	18 42	19 50
52	05 57	06 38	07 16	17 03	17 53	18 52	19 59
50	05 54	06 34	07 09	17 13	18 03	19 02	20 07
45	05 47	06 23	06 54	17 34	18 24	19 21	20 24
N 40	05 41	06 13	06 42	17 51	18 41	19 37	20 38
35	05 35	06 05	06 32	18 05	18 56	19 51	20 49
30	05 29	05 58	06 23	18 17	19 08	20 03	21 00
20	05 18	05 44	06 07	18 39	19 29	20 23	21 17
N 10	05 06	05 32	05 54	18 57	19 48	20 40	21 33
0	04 54	05 19	05 41	19 14	20 05	20 56	21 47
S 10	04 39	05 05	05 28	19 32	20 22	21 13	22 01
20	04 22	04 50	05 13	19 50	20 41	21 30	22 17
30	04 00	04 31	04 57	20 11	21 02	21 50	22 34
35	03 46	04 20	04 48	20 24	21 15	22 01	22 44
40	03 29	04 06	04 37	20 38	21 29	22 15	22 56
45	03 08	03 50	04 24	20 56	21 46	22 31	23 09
S 50	02 39	03 29	04 08	21 17	22 07	22 50	23 26
52	02 24	03 19	04 01	21 27	22 17	22 59	23 34
54	02 06	03 08	03 52	21 38	22 28	23 09	23 42
56	01 44	02 55	03 43	21 51	22 41	23 21	23 52
58	01 13	02 39	03 32	22 07	22 56	23 34	24 03
S 60	00 11	02 20	03 20	22 25	23 14	23 50	24 15

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 12	Moonset 13	Moonset 14	Moonset 15
°	h m	h m	h m	h m	h m	h m	h m
N 72	12 59	15 04	16 36				
N 70	13 53	15 25	16 46				14 41
68	14 26	15 42	16 53			13 53	13 38
66	14 49	15 55	17 00	11 21	12 21	12 51	13 03
64	15 08	16 06	17 06	10 41	11 39	12 16	12 38
62	15 23	16 16	17 11	10 14	11 10	11 51	12 18
60	15 36	16 24	17 15	09 53	10 48	11 31	12 01
N 58	15 47	16 31	17 20	09 36	10 30	11 14	11 47
56	15 56	16 38	17 23	09 21	10 16	11 00	11 35
54	16 05	16 44	17 27	09 09	10 03	10 48	11 25
52	16 12	16 49	17 30	08 58	09 51	10 37	11 15
50	16 19	16 54	17 33	08 48	09 41	10 28	11 07
45	16 34	17 05	17 41	08 27	09 20	10 08	10 49
N 40	16 46	17 15	17 47	08 10	09 03	09 51	10 34
35	16 56	17 23	17 53	07 56	08 49	09 37	10 22
30	17 05	17 30	17 59	07 44	08 36	09 25	10 11
20	17 21	17 44	18 11	07 23	08 15	09 05	09 52
N 10	17 35	17 57	18 22	07 05	07 56	08 47	09 36
0	17 48	18 10	18 35	06 48	07 39	08 30	09 21
S 10	18 01	18 23	18 49	06 31	07 21	08 13	09 05
20	18 15	18 39	19 06	06 13	07 03	07 55	08 49
30	18 32	18 58	19 29	05 53	06 41	07 34	08 30
35	18 41	19 09	19 43	05 40	06 29	07 22	08 19
40	18 52	19 23	20 00	05 26	06 14	07 07	08 06
45	19 05	19 39	20 22	05 10	05 57	06 51	07 50
S 50	19 21	20 00	20 51	04 50	05 36	06 30	07 32
52	19 29	20 10	21 06	04 40	05 25	06 20	07 23
54	19 37	20 22	21 25	04 29	05 14	06 09	07 13
56	19 47	20 35	21 48	04 17	05 01	05 56	07 02
58	19 58	20 51	22 21	04 02	04 46	05 41	06 49
S 60	20 10	21 11	////	03 46	04 27	05 24	06 33

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
12	15 58	15 54	11 44	00 36	13 01	17	98
13	15 50	15 46	11 44	01 26	13 52	18	94
14	15 42	15 38	11 44	02 17	14 43	19	88

SATURDAY

SUNDAY

MONDAY

UT	ARIES	VENUS −3.8		MARS +0.9		JUPITER −2.9		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
15 00	53 44.3	159 22.3	S23 31.1	259 09.1	N12 32.2	22 22.5	N11 10.7	210 40.0	S 7 11.4
01	68 46.8	174 21.4	31.5	274 10.3	31.8	37 25.3	10.6	225 42.2	11.5
02	83 49.3	189 20.5	31.9	289 11.6	31.4	52 28.1	10.5	240 44.4	11.6
03	98 51.7	204 19.6	32.4	304 12.9	31.0	67 30.8	10.4	255 46.6	11.7
04	113 54.2	219 18.7	32.8	319 14.2	30.6	82 33.6	10.3	270 48.8	11.8
05	128 56.6	234 17.8	33.2	334 15.4	30.2	97 36.3	10.2	285 51.0	11.9
06	143 59.1	249 16.9	S23 33.6	349 16.7	N12 29.8	112 39.1	N11 10.2	300 53.2	S 7 12.0
07	159 01.6	264 16.0	34.1	4 18.0	29.4	127 41.8	10.1	315 55.4	12.1
T 08	174 04.0	279 15.2	34.5	19 19.2	29.0	142 44.6	10.0	330 57.6	12.2
U 09	189 06.5	294 14.3	34.9	34 20.5	28.6	157 47.3	09.9	345 59.8	12.3
E 10	204 09.0	309 13.4	35.3	49 21.8	28.2	172 50.1	09.8	1 02.0	12.4
S 11	219 11.4	324 12.5	35.8	64 23.1	27.8	187 52.8	09.7	16 04.2	12.5
D 12	234 13.9	339 11.6	S23 36.2	79 24.3	N12 27.4	202 55.6	N11 09.6	31 06.4	S 7 12.6
A 13	249 16.4	354 10.7	36.6	94 25.6	27.0	217 58.4	09.5	46 08.6	12.7
Y 14	264 18.8	9 09.8	37.0	109 26.9	26.6	233 01.1	09.4	61 10.8	12.8
15	279 21.3	24 08.9	37.4	124 28.2	26.2	248 03.9	09.3	76 13.0	12.9
16	294 23.7	39 08.0	37.8	139 29.4	25.8	263 06.6	09.2	91 15.2	12.9
17	309 26.2	54 07.1	38.3	154 30.7	25.4	278 09.4	09.1	106 17.4	13.0
18	324 28.7	69 06.2	S23 38.7	169 32.0	N12 25.0	293 12.1	N11 09.0	121 19.6	S 7 13.1
19	339 31.1	84 05.3	39.1	184 33.3	24.6	308 14.9	08.9	136 21.8	13.2
20	354 33.6	99 04.4	39.5	199 34.5	24.2	323 17.6	08.8	151 24.0	13.3
21	9 36.1	114 03.5	39.9	214 35.8	23.8	338 20.4	08.7	166 26.2	13.4
22	24 38.5	129 02.6	40.3	229 37.1	23.4	353 23.1	08.6	181 28.4	13.5
23	39 41.0	144 01.7	40.7	244 38.4	23.0	8 25.9	08.6	196 30.6	13.6
16 00	54 43.5	159 00.8	S23 41.1	259 39.7	N12 22.6	23 28.6	N11 08.5	211 32.8	S 7 13.7
01	69 45.9	173 59.9	41.5	274 40.9	22.2	38 31.4	08.4	226 35.0	13.8
02	84 48.4	188 59.0	41.9	289 42.2	21.8	53 34.1	08.3	241 37.2	13.9
03	99 50.9	203 58.1	42.3	304 43.5	21.4	68 36.9	08.2	256 39.4	14.0
04	114 53.3	218 57.2	42.7	319 44.8	21.0	83 39.6	08.1	271 41.6	14.1
05	129 55.8	233 56.3	43.1	334 46.1	20.6	98 42.4	08.0	286 43.8	14.2
06	144 58.2	248 55.4	S23 43.5	349 47.3	N12 20.2	113 45.1	N11 07.9	301 46.0	S 7 14.3
W 07	160 00.7	263 54.5	43.9	4 48.6	19.8	128 47.9	07.8	316 48.2	14.4
E 08	175 03.2	278 53.6	44.3	19 49.9	19.4	143 50.6	07.7	331 50.4	14.5
D 09	190 05.6	293 52.7	44.7	34 51.2	19.0	158 53.4	07.6	346 52.6	14.6
N 10	205 08.1	308 51.8	45.1	49 52.5	18.7	173 56.1	07.5	1 54.8	14.7
E 11	220 10.6	323 50.9	45.5	64 53.7	18.3	188 58.9	07.4	16 57.0	14.8
S 12	235 13.0	338 50.0	S23 45.9	79 55.0	N12 17.9	204 01.6	N11 07.3	31 59.2	S 7 14.9
D 13	250 15.5	353 49.1	46.3	94 56.3	17.5	219 04.4	07.2	47 01.4	15.0
A 14	265 18.0	8 48.2	46.7	109 57.6	17.1	234 07.1	07.2	62 03.6	15.1
Y 15	280 20.4	23 47.3	47.1	124 58.9	16.7	249 09.9	07.1	77 05.8	15.2
16	295 22.9	38 46.4	47.4	140 00.2	16.3	264 12.6	07.0	92 08.0	15.3
17	310 25.4	53 45.5	47.8	155 01.4	15.9	279 15.4	06.9	107 10.2	15.4
18	325 27.8	68 44.6	S23 48.2	170 02.7	N12 15.5	294 18.1	N11 06.8	122 12.4	S 7 15.5
19	340 30.3	83 43.7	48.6	185 04.0	15.1	309 20.9	06.7	137 14.6	15.6
20	355 32.7	98 42.8	49.0	200 05.3	14.7	324 23.6	06.6	152 16.9	15.7
21	10 35.2	113 41.9	49.3	215 06.6	14.3	339 26.4	06.5	167 19.1	15.8
22	25 37.7	128 41.0	49.7	230 07.9	13.9	354 29.1	06.4	182 21.3	15.9
23	40 40.1	143 40.1	50.1	245 09.2	13.5	9 31.9	06.3	197 23.5	16.0
17 00	55 42.6	158 39.2	S23 50.5	260 10.5	N12 13.1	24 34.6	N11 06.2	212 25.7	S 7 16.1
01	70 45.1	173 38.3	50.9	275 11.7	12.7	39 37.4	06.1	227 27.9	16.2
02	85 47.5	188 37.4	51.2	290 13.0	12.3	54 40.1	06.1	242 30.1	16.3
03	100 50.0	203 36.5	51.6	305 14.3	11.9	69 42.9	06.0	257 32.3	16.4
04	115 52.5	218 35.5	52.0	320 15.6	11.5	84 45.6	05.9	272 34.5	16.5
05	130 54.9	233 34.6	52.3	335 16.9	11.1	99 48.3	05.8	287 36.7	16.6
06	145 57.4	248 33.7	S23 52.7	350 18.2	N12 10.7	114 51.1	N11 05.7	302 38.9	S 7 16.7
07	160 59.9	263 32.8	53.1	5 19.5	10.3	129 53.8	05.6	317 41.1	16.8
T 08	176 02.3	278 31.9	53.4	20 20.8	09.9	144 56.6	05.5	332 43.3	16.9
H 09	191 04.8	293 31.0	53.8	35 22.1	09.6	159 59.3	05.4	347 45.5	16.9
U 10	206 07.2	308 30.1	54.2	50 23.3	09.2	175 02.1	05.3	2 47.7	17.0
R 11	221 09.7	323 29.2	54.5	65 24.6	08.8	190 04.8	05.2	17 49.9	17.1
S 12	236 12.2	338 28.3	S23 54.9	80 25.9	N12 08.4	205 07.6	N11 05.1	32 52.1	S 7 17.2
D 13	251 14.6	353 27.4	55.3	95 27.2	08.0	220 10.3	05.0	47 54.3	17.3
A 14	266 17.1	8 26.5	55.6	110 28.5	07.6	235 13.0	05.0	62 56.5	17.4
Y 15	281 19.6	23 25.5	56.0	125 29.8	07.2	250 15.8	04.9	77 58.7	17.5
16	296 22.0	38 24.6	56.3	140 31.1	06.8	265 18.5	04.8	93 00.9	17.6
17	311 24.5	53 23.7	56.7	155 32.4	06.4	280 21.3	04.7	108 03.1	17.7
18	326 27.0	68 22.8	S23 57.0	170 33.7	N12 06.0	295 24.0	N11 04.6	123 05.3	S 7 17.8
19	341 29.4	83 21.9	57.4	185 35.0	05.6	310 26.8	04.5	138 07.5	17.9
20	356 31.9	98 21.0	57.7	200 36.3	05.2	325 29.5	04.4	153 09.7	18.0
21	11 34.3	113 20.1	58.1	215 37.6	04.8	340 32.3	04.3	168 11.9	18.1
22	26 36.8	128 19.2	58.4	230 38.9	04.4	355 35.0	04.2	183 14.1	18.2
23	41 39.3	143 18.3	58.8	245 40.2	04.0	10 37.7	04.1	198 16.3	18.3
	h m								
Mer. Pass.	20 17.8	v −0.9	d 0.4	v 1.3	d 0.4	v 2.7	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.7	S40 15.4
Achernar	335 27.0	S57 10.6
Acrux	173 11.1	S63 09.7
Adhara	255 13.2	S28 59.2
Aldebaran	290 50.3	N16 32.0
Alioth	166 22.1	N55 53.5
Alkaid	153 00.2	N49 15.1
Al Na'ir	27 45.1	S46 54.3
Alnilam	275 47.2	S 1 11.7
Alphard	217 57.2	S 8 42.6
Alphecca	126 12.3	N26 40.6
Alpheratz	357 44.5	N29 09.7
Altair	62 09.5	N 8 54.2
Ankaa	353 16.5	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.2
Atria	107 31.4	S69 02.9
Avior	234 18.3	S59 32.7
Bellatrix	278 32.9	N 6 21.6
Betelgeuse	271 02.2	N 7 24.5
Canopus	263 56.2	S52 42.0
Capella	280 35.7	N46 00.5
Deneb	49 32.4	N45 19.8
Denebola	182 35.0	N14 30.2
Diphda	348 56.8	S17 55.2
Dubhe	193 53.3	N61 40.9
Elnath	278 13.7	N28 37.0
Eltanin	90 47.1	N51 29.5
Enif	33 48.2	N 9 56.0
Fomalhaut	15 25.1	S29 33.5
Gacrux	172 02.6	S57 10.6
Gienah	175 53.7	S17 36.4
Hadar	148 50.2	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.1	N74 06.3
Markab	13 39.3	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.3	S36 25.6
Miaplacidus	221 39.8	S69 45.7
Mirfak	308 41.5	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.2	S56 41.9
Pollux	243 28.9	N27 59.7
Procyon	245 00.7	N 5 11.6
Rasalhague	96 07.8	N12 33.3
Regulus	207 44.7	N11 54.4
Rigel	281 12.8	S 8 11.2
Rigil Kent.	139 54.0	S60 52.9
Sabik	102 14.2	S15 44.3
Schedar	349 41.4	N56 36.5
Shaula	96 23.8	S37 06.7
Sirius	258 34.5	S16 43.9
Spica	158 32.7	S11 13.3
Suhail	222 53.2	S43 28.7
Vega	80 40.0	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	104 17.4	13 25
Mars	204 56.2	6 41
Jupiter	328 45.2	22 22
Saturn	156 49.4	9 52

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
15 00	183 53.3	S18 20.0	314 28.6	10.2	N20 59.2	4.6	55.7
01	198 53.2	20.6	328 57.8	10.3	20 54.6	4.8	55.7
02	213 53.1	21.3	343 27.1	10.3	20 49.8	4.9	55.7
03	228 53.0	21.9	357 56.4	10.2	20 44.9	5.0	55.8
04	243 52.9	22.6	12 25.6	10.3	20 39.9	5.1	55.8
05	258 52.8	23.2	26 54.9	10.3	20 34.8	5.3	55.8
06	273 52.7	S18 23.8	41 24.2	10.3	N20 29.5	5.3	55.8
07	288 52.6	24.5	55 53.5	10.4	20 24.2	5.4	55.9
T 08	303 52.4	25.1	70 22.9	10.3	20 18.8	5.6	55.9
U 09	318 52.3	25.8	84 52.2	10.4	20 13.2	5.6	55.9
E 10	333 52.2	26.4	99 21.6	10.4	20 07.6	5.8	55.9
S 11	348 52.1	27.0	113 51.0	10.4	20 01.8	5.9	55.9
D 12	3 52.0	S18 27.7	128 20.4	10.4	N19 55.9	5.9	56.0
A 13	18 51.9	28.3	142 49.8	10.4	19 50.0	6.1	56.0
Y 14	33 51.8	29.0	157 19.2	10.5	19 43.9	6.2	56.0
15	48 51.7	29.6	171 48.7	10.4	19 37.7	6.3	56.0
16	63 51.6	30.2	186 18.1	10.5	19 31.4	6.4	56.1
17	78 51.5	30.9	200 47.6	10.5	19 25.0	6.5	56.1
18	93 51.4	S18 31.5	215 17.1	10.6	N19 18.5	6.6	56.1
19	108 51.3	32.1	229 46.7	10.5	19 11.9	6.7	56.1
20	123 51.2	32.8	244 16.2	10.6	19 05.2	6.8	56.2
21	138 51.1	33.4	258 45.8	10.5	18 58.4	6.9	56.2
22	153 51.0	34.0	273 15.3	10.6	18 51.5	7.1	56.2
23	168 50.9	34.7	287 44.9	10.7	18 44.4	7.1	56.2
16 00	183 50.8	S18 35.3	302 14.6	10.6	N18 37.3	7.2	56.3
01	198 50.7	35.9	316 44.2	10.7	18 30.1	7.3	56.3
02	213 50.6	36.6	331 13.9	10.6	18 22.8	7.4	56.3
03	228 50.4	37.2	345 43.5	10.7	18 15.4	7.5	56.3
04	243 50.3	37.8	0 13.2	10.8	18 07.9	7.7	56.4
05	258 50.2	38.5	14 43.0	10.7	18 00.2	7.7	56.4
06	273 50.1	S18 39.1	29 12.7	10.7	N17 52.5	7.8	56.4
W 07	288 50.0	39.7	43 42.4	10.8	17 44.7	7.9	56.4
E 08	303 49.9	40.3	58 12.2	10.8	17 36.8	8.0	56.5
D 09	318 49.8	41.0	72 42.0	10.8	17 28.8	8.1	56.5
N 10	333 49.7	41.6	87 11.8	10.9	17 20.7	8.2	56.5
E 11	348 49.6	42.2	101 41.7	10.8	17 12.5	8.3	56.5
S 12	3 49.5	S18 42.9	116 11.5	10.9	N17 04.2	8.4	56.6
D 13	18 49.3	43.5	130 41.4	10.9	16 55.8	8.4	56.6
A 14	33 49.2	44.1	145 11.3	11.0	16 47.4	8.6	56.6
Y 15	48 49.1	44.7	159 41.3	10.9	16 38.8	8.7	56.6
16	63 49.0	45.3	174 11.2	11.0	16 30.1	8.7	56.7
17	78 48.9	46.0	188 41.2	10.9	16 21.4	8.9	56.7
18	93 48.8	S18 46.6	203 11.1	11.0	N16 12.5	8.9	56.7
19	108 48.7	47.2	217 41.1	11.1	16 03.6	9.0	56.8
20	123 48.5	47.8	232 11.2	11.0	15 54.6	9.1	56.8
21	138 48.4	48.5	246 41.2	11.0	15 45.5	9.2	56.8
22	153 48.3	49.1	261 11.2	11.1	15 36.3	9.3	56.8
23	168 48.2	49.7	275 41.3	11.1	15 27.0	9.4	56.9
17 00	183 48.1	S18 50.3	290 11.4	11.1	N15 17.6	9.5	56.9
01	198 48.0	50.9	304 41.5	11.2	15 08.1	9.5	56.9
02	213 47.8	51.5	319 11.7	11.1	14 58.6	9.6	56.9
03	228 47.7	52.2	333 41.8	11.2	14 49.0	9.8	57.0
04	243 47.6	52.8	348 12.0	11.2	14 39.2	9.8	57.0
05	258 47.5	53.4	2 42.2	11.2	14 29.4	9.8	57.0
06	273 47.4	S18 54.0	17 12.4	11.2	N14 19.6	10.0	57.1
T 07	288 47.3	54.6	31 42.6	11.2	14 09.6	10.1	57.1
H 08	303 47.1	55.2	46 12.8	11.3	13 59.5	10.1	57.1
U 09	318 47.0	55.9	60 43.1	11.2	13 49.4	10.2	57.1
R 10	333 46.9	56.5	75 13.3	11.3	13 39.2	10.3	57.2
S 11	348 46.8	57.1	89 43.6	11.3	13 28.9	10.3	57.2
D 12	3 46.7	S18 57.7	104 13.9	11.3	N13 18.6	10.5	57.2
A 13	18 46.5	58.3	118 44.2	11.3	13 08.1	10.5	57.3
Y 14	33 46.4	58.9	133 14.5	11.4	12 57.6	10.6	57.3
15	48 46.3	18 59.5	147 44.9	11.3	12 47.0	10.7	57.3
16	63 46.2	19 00.1	162 15.2	11.4	12 36.3	10.7	57.4
17	78 46.0	00.7	176 45.6	11.4	12 25.6	10.8	57.4
18	93 45.9	S19 01.3	191 16.0	11.3	N12 14.8	10.9	57.4
19	108 45.8	02.0	205 46.3	11.4	12 03.9	11.0	57.4
20	123 45.7	02.6	220 16.7	11.5	11 52.9	11.0	57.5
21	138 45.6	03.2	234 47.2	11.4	11 41.9	11.2	57.5
22	153 45.4	03.8	249 17.6	11.4	11 30.7	11.1	57.5
23	168 45.3	04.4	263 48.0	11.4	N11 19.6	11.3	57.6
	SD 16.2	d 0.6	SD 15.2		15.4		15.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 15	Moonrise 16	Moonrise 17	Moonrise 18
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 02	08 37	11 17	▭	18 19	20 43	22 51
N 70	06 51	08 14	09 54	16 37	19 03	21 04	23 00
68	06 43	07 56	09 16	17 39	19 32	21 21	23 08
66	06 35	07 41	08 49	18 14	19 53	21 34	23 15
64	06 29	07 29	08 29	18 39	20 10	21 44	23 20
62	06 23	07 19	08 13	18 59	20 24	21 54	23 25
60	06 18	07 10	07 59	19 14	20 36	22 01	23 29
N 58	06 14	07 02	07 48	19 28	20 46	22 08	23 33
56	06 09	06 55	07 38	19 39	20 55	22 14	23 36
54	06 06	06 49	07 29	19 50	21 03	22 20	23 39
52	06 02	06 43	07 21	19 59	21 10	22 25	23 41
50	05 59	06 38	07 14	20 07	21 16	22 29	23 44
45	05 51	06 27	06 58	20 24	21 30	22 38	23 49
N 40	05 44	06 17	06 46	20 38	21 41	22 46	23 53
35	05 37	06 08	06 35	20 49	21 50	22 53	23 57
30	05 31	06 00	06 25	21 00	21 59	22 59	24 00
20	05 19	05 46	06 09	21 17	22 13	23 09	24 06
N 10	05 07	05 33	05 55	21 33	22 25	23 18	24 10
0	04 54	05 19	05 41	21 47	22 37	23 26	24 15
S 10	04 39	05 05	05 27	22 01	22 49	23 34	24 20
20	04 21	04 49	05 13	22 17	23 01	23 43	24 25
30	03 58	04 29	04 56	22 34	23 15	23 53	24 30
35	03 44	04 18	04 46	22 44	23 23	23 59	24 33
40	03 26	04 04	04 34	22 56	23 32	24 06	00 06
45	03 03	03 46	04 21	23 09	23 43	24 13	00 13
S 50	02 33	03 25	04 04	23 26	23 56	24 22	00 22
52	02 17	03 14	03 56	23 34	24 02	00 02	00 26
54	01 57	03 02	03 47	23 42	24 09	00 09	00 31
56	01 32	02 48	03 37	23 52	24 16	00 16	00 36
58	00 56	02 31	03 26	24 03	00 03	00 24	00 42
S 60	////	02 11	03 13	24 15	00 15	00 34	00 48

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 15	Moonset 16	Moonset 17	Moonset 18
°	h m	h m	h m	h m	h m	h m	h m
N 72	12 12	14 51	16 26	▭	14 46	14 05	13 41
N 70	13 35	15 14	16 37	14 41	14 01	13 42	13 29
68	14 13	15 32	16 46	13 38	13 31	13 24	13 19
66	14 39	15 47	16 53	13 03	13 08	13 10	13 10
64	14 59	15 59	17 00	12 38	12 50	12 58	13 03
62	15 16	16 10	17 05	12 18	12 35	12 48	12 57
60	15 29	16 18	17 10	12 01	12 23	12 39	12 52
N 58	15 41	16 26	17 15	11 47	12 12	12 31	12 47
56	15 51	16 33	17 19	11 35	12 03	12 25	12 43
54	16 00	16 40	17 23	11 25	11 54	12 18	12 39
52	16 08	16 46	17 27	11 15	11 47	12 13	12 36
50	16 15	16 51	17 30	11 07	11 40	12 08	12 33
45	16 31	17 02	17 38	10 49	11 25	11 57	12 26
N 40	16 43	17 12	17 45	10 34	11 13	11 48	12 20
35	16 54	17 21	17 52	10 22	11 03	11 40	12 15
30	17 04	17 29	17 58	10 11	10 54	11 33	12 11
20	17 20	17 43	18 10	09 52	10 38	11 21	12 03
N 10	17 35	17 57	18 22	09 36	10 24	11 11	11 56
0	17 48	18 10	18 35	09 21	10 11	11 01	11 49
S 10	18 02	18 24	18 51	09 05	09 58	10 51	11 43
20	18 17	18 41	19 09	08 49	09 44	10 40	11 36
30	18 34	19 00	19 32	08 30	09 28	10 27	11 28
35	18 44	19 12	19 46	08 19	09 18	10 20	11 23
40	18 56	19 27	20 04	08 06	09 08	10 12	11 18
45	19 10	19 44	20 27	07 50	08 55	10 02	11 12
S 50	19 26	20 06	20 58	07 32	08 39	09 50	11 04
52	19 34	20 17	21 15	07 23	08 32	09 45	11 01
54	19 43	20 29	21 34	07 13	08 24	09 39	10 57
56	19 53	20 43	22 00	07 02	08 15	09 32	10 53
58	20 05	21 00	22 40	06 49	08 04	09 25	10 48
S 60	20 18	21 21	////	06 33	07 52	09 16	10 43

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
15	15 33	15 28	11 45	03 09	15 34	20	81
16	15 23	15 18	11 45	03 59	16 24	21	72
17	15 13	15 07	11 45	04 49	17 13	22	62

UT	ARIES	VENUS −3.9		MARS +0.9		JUPITER −2.9		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
18 00	56 41.7	158 17.3	S23 59.1	260 41.5	N12 03.6	25 40.5	N11 04.1	213 18.5	S 7 18.4
01	71 44.2	173 16.4	59.5	275 42.8	03.2	40 43.2	04.0	228 20.7	18.5
02	86 46.7	188 15.5	23 59.8	290 44.1	02.9	55 46.0	03.9	243 22.9	18.6
03	101 49.1	203 14.6	24 00.2	305 45.4	02.5	70 48.7	03.8	258 25.1	18.7
04	116 51.6	218 13.7	00.5	320 46.7	02.1	85 51.4	03.7	273 27.3	18.8
05	131 54.1	233 12.8	00.8	335 48.0	01.7	100 54.2	03.6	288 29.5	18.9
06	146 56.5	248 11.9	S24 01.2	350 49.3	N12 01.3	115 56.9	N11 03.5	303 31.7	S 7 19.0
07	161 59.0	263 10.9	01.5	5 50.6	00.9	130 59.7	03.4	318 33.9	19.1
08	177 01.5	278 10.0	01.9	20 51.9	00.5	146 02.4	03.3	333 36.1	19.2
F 09	192 03.9	293 09.1	02.2	35 53.2	12 00.1	161 05.2	03.2	348 38.3	19.3
R 10	207 06.4	308 08.2	02.5	50 54.5	11 59.7	176 07.9	03.2	3 40.5	19.4
I 11	222 08.8	323 07.3	02.9	65 55.8	59.3	191 10.6	03.1	18 42.7	19.5
D 12	237 11.3	338 06.4	S24 03.2	80 57.1	N11 58.9	206 13.4	N11 03.0	33 44.9	S 7 19.6
A 13	252 13.8	353 05.4	03.5	95 58.4	58.5	221 16.1	02.9	48 47.2	19.6
Y 14	267 16.2	8 04.5	03.9	110 59.7	58.1	236 18.9	02.8	63 49.4	19.7
15	282 18.7	23 03.6	04.2	126 01.0	57.7	251 21.6	02.7	78 51.6	19.8
16	297 21.2	38 02.7	04.5	141 02.3	57.3	266 24.3	02.6	93 53.8	19.9
17	312 23.6	53 01.8	04.8	156 03.6	57.0	281 27.1	02.5	108 56.0	20.0
18	327 26.1	68 00.9	S24 05.2	171 04.9	N11 56.6	296 29.8	N11 02.4	123 58.2	S 7 20.1
19	342 28.6	82 59.9	05.5	186 06.2	56.2	311 32.6	02.4	139 00.4	20.2
20	357 31.0	97 59.0	05.8	201 07.5	55.8	326 35.3	02.3	154 02.6	20.3
21	12 33.5	112 58.1	06.1	216 08.8	55.4	341 38.0	02.2	169 04.8	20.4
22	27 36.0	127 57.2	06.4	231 10.1	55.0	356 40.8	02.1	184 07.0	20.5
23	42 38.4	142 56.3	06.8	246 11.4	54.6	11 43.5	02.0	199 09.2	20.6
19 00	57 40.9	157 55.3	S24 07.1	261 12.7	N11 54.2	26 46.2	N11 01.9	214 11.4	S 7 20.7
01	72 43.3	172 54.4	07.4	276 14.0	53.8	41 49.0	01.8	229 13.6	20.8
02	87 45.8	187 53.5	07.7	291 15.3	53.4	56 51.7	01.7	244 15.8	20.9
03	102 48.3	202 52.6	08.0	306 16.6	53.0	71 54.5	01.6	259 18.0	21.0
04	117 50.7	217 51.7	08.3	321 17.9	52.6	86 57.2	01.6	274 20.2	21.1
05	132 53.2	232 50.7	08.6	336 19.2	52.3	101 59.9	01.5	289 22.4	21.2
06	147 55.7	247 49.8	S24 08.9	351 20.5	N11 51.9	117 02.7	N11 01.4	304 24.6	S 7 21.3
07	162 58.1	262 48.9	09.3	6 21.8	51.5	132 05.4	01.3	319 26.8	21.4
S 08	178 00.6	277 48.0	09.6	21 23.2	51.1	147 08.1	01.2	334 29.0	21.5
A 09	193 03.1	292 47.1	09.9	36 24.5	50.7	162 10.9	01.1	349 31.2	21.6
T 10	208 05.5	307 46.1	10.2	51 25.8	50.3	177 13.6	01.0	4 33.4	21.7
U 11	223 08.0	322 45.2	10.5	66 27.1	49.9	192 16.3	00.9	19 35.7	21.7
R 12	238 10.4	337 44.3	S24 10.8	81 28.4	N11 49.5	207 19.1	N11 00.9	34 37.9	S 7 21.8
D 13	253 12.9	352 43.4	11.1	96 29.7	49.1	222 21.8	00.8	49 40.1	21.9
A 14	268 15.4	7 42.4	11.4	111 31.0	48.7	237 24.5	00.7	64 42.3	22.0
Y 15	283 17.8	22 41.5	11.7	126 32.3	48.3	252 27.3	00.6	79 44.5	22.1
16	298 20.3	37 40.6	12.0	141 33.6	47.9	267 30.0	00.5	94 46.7	22.2
17	313 22.8	52 39.7	12.3	156 35.0	47.6	282 32.7	00.4	109 48.9	22.3
18	328 25.2	67 38.7	S24 12.6	171 36.3	N11 47.2	297 35.5	N11 00.3	124 51.1	S 7 22.4
19	343 27.7	82 37.8	12.9	186 37.6	46.8	312 38.2	00.2	139 53.3	22.5
20	358 30.2	97 36.9	13.1	201 38.9	46.4	327 40.9	00.2	154 55.5	22.6
21	13 32.6	112 36.0	13.4	216 40.2	46.0	342 43.7	00.1	169 57.7	22.7
22	28 35.1	127 35.0	13.7	231 41.5	45.6	357 46.4	11 00.0	184 59.9	22.8
23	43 37.6	142 34.1	14.0	246 42.8	45.2	12 49.1	10 59.9	200 02.1	22.9
20 00	58 40.0	157 33.2	S24 14.3	261 44.2	N11 44.8	27 51.9	N10 59.8	215 04.3	S 7 23.0
01	73 42.5	172 32.3	14.6	276 45.5	44.4	42 54.6	59.7	230 06.5	23.1
02	88 44.9	187 31.3	14.9	291 46.8	44.0	57 57.3	59.6	245 08.7	23.2
03	103 47.4	202 30.4	15.1	306 48.1	43.7	73 00.1	59.6	260 10.9	23.3
04	118 49.9	217 29.5	15.4	321 49.4	43.3	88 02.8	59.5	275 13.1	23.4
05	133 52.3	232 28.6	15.7	336 50.7	42.9	103 05.5	59.4	290 15.4	23.5
06	148 54.8	247 27.6	S24 16.0	351 52.1	N11 42.5	118 08.3	N10 59.3	305 17.6	S 7 23.6
07	163 57.3	262 26.7	16.3	♁ 53.4	42.1	133 11.0	59.2	320 19.8	23.6
08	178 59.7	277 25.8	16.5	21 54.7	41.7	148 13.7	59.1	335 22.0	23.7
S 09	194 02.2	292 24.8	16.8	36 56.0	41.3	163 16.5	59.0	350 24.2	23.8
U 10	209 04.7	307 23.9	17.1	51 57.3	40.9	178 19.2	59.0	5 26.4	23.9
N 11	224 07.1	322 23.0	17.4	66 58.6	40.5	193 21.9	58.9	20 28.6	24.0
D 12	239 09.6	337 22.1	S24 17.6	82 00.0	N11 40.2	208 24.7	N10 58.8	35 30.8	S 7 24.1
A 13	254 12.0	352 21.1	17.9	97 01.3	39.8	223 27.4	58.7	50 33.0	24.2
Y 14	269 14.5	7 20.2	18.2	112 02.6	39.4	238 30.1	58.6	65 35.2	24.3
15	284 17.0	22 19.3	18.4	127 03.9	39.0	253 32.8	58.5	80 37.4	24.4
16	299 19.4	37 18.3	18.7	142 05.2	38.6	268 35.6	58.4	95 39.6	24.5
17	314 21.9	52 17.4	19.0	157 06.6	38.2	283 38.3	58.4	110 41.8	24.6
18	329 24.4	67 16.5	S24 19.2	172 07.9	N11 37.8	298 41.0	N10 58.3	125 44.0	S 7 24.7
19	344 26.8	82 15.6	19.5	187 09.2	37.4	313 43.8	58.2	140 46.2	24.8
20	359 29.3	97 14.6	19.8	202 10.5	37.0	328 46.5	58.1	155 48.5	24.9
21	14 31.8	112 13.7	20.0	217 11.9	36.7	343 49.2	58.0	170 50.7	25.0
22	29 34.2	127 12.8	20.3	232 13.2	36.3	358 51.9	57.9	185 52.9	25.1
23	44 36.7	142 11.8	20.5	247 14.5	35.9	13 54.7	57.9	200 55.1	25.2
	h m								
Mer. Pass.	20 06.0	v −0.9	d 0.3	v 1.3	d 0.4	v 2.7	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.7	S40 15.4
Achernar	335 27.1	S57 10.6
Acrux	173 11.1	S63 09.7
Adhara	255 13.1	S28 59.2
Aldebaran	290 50.3	N16 32.0
Alioth	166 22.0	N55 53.5
Alkaid	153 00.2	N49 15.1
Al Na'ir	27 45.1	S46 54.3
Alnilam	275 47.2	S 1 11.7
Alphard	217 57.2	S 8 42.6
Alphecca	126 12.3	N26 40.5
Alpheratz	357 44.5	N29 09.7
Altair	62 09.5	N 8 54.2
Ankaa	353 16.5	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.2
Atria	107 31.4	S69 02.9
Avior	234 18.2	S59 32.7
Bellatrix	278 32.9	N 6 21.6
Betelgeuse	271 02.2	N 7 24.5
Canopus	263 56.2	S52 42.0
Capella	280 35.7	N46 00.5
Deneb	49 32.4	N45 19.8
Denebola	182 35.0	N14 30.2
Diphda	348 56.8	S17 55.2
Dubhe	193 53.2	N61 40.8
Elnath	278 13.7	N28 37.0
Eltanin	90 47.1	N51 29.5
Enif	33 48.2	N 9 56.0
Fomalhaut	15 25.1	S29 33.5
Gacrux	172 02.6	S57 10.6
Gienah	175 53.7	S17 36.4
Hadar	148 50.1	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.1	N74 06.3
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.3	S36 25.6
Miaplacidus	221 39.8	S69 45.7
Mirfak	308 41.5	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.2	S56 41.9
Pollux	243 28.9	N27 59.6
Procyon	245 00.7	N 5 11.6
Rasalhague	96 07.8	N12 33.3
Regulus	207 44.7	N11 54.4
Rigel	281 12.8	S 8 11.3
Rigil Kent.	139 53.9	S60 52.9
Sabik	102 14.2	S15 44.3
Schedar	349 41.4	N56 36.5
Shaula	96 23.8	S37 06.7
Sirius	258 34.4	S16 43.9
Spica	158 32.7	S11 13.3
Suhail	222 53.2	S43 28.7
Vega	80 40.1	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	100 14.5	13 29
Mars	203 31.8	6 35
Jupiter	329 05.4	22 09
Saturn	156 30.5	9 42

UT	SUN		MOON					Lat.	Twilight		Sunrise	Moonrise			
									Naut.	Civil		18	19	20	21
	GHA	Dec	GHA	v	Dec	d	HP								
d h	° ′	° ′	° ′	′	° ′	′	′		h m	h m	h m	h m	h m	h m	h m
18 00	183 45.2	S19 05.0	278 18.4	11.5	N11 08.3	11.3	57.6	N 72	07 12	08 51	▬	22 51	24 55	00 55	03 02
01	198 45.1	05.6	292 48.9	11.4	10 57.0	11.4	57.6	N 70	07 01	08 26	10 15	23 00	24 56	00 56	02 54
02	213 44.9	06.2	307 19.3	11.5	10 45.6	11.4	57.7	68	06 51	08 06	09 30	23 08	24 57	00 57	02 48
03	228 44.8	. . 06.8	321 49.8	11.4	10 34.2	11.5	57.7	66	06 43	07 50	09 01	23 15	24 57	00 57	02 43
04	243 44.7	07.4	336 20.2	11.5	10 22.7	11.6	57.7	64	06 36	07 37	08 39	23 20	24 58	00 58	02 38
05	258 44.5	08.0	350 50.7	11.5	10 11.1	11.7	57.7	62	06 30	07 26	08 21	23 25	24 58	00 58	02 35
06	273 44.4	S19 08.6	5 21.2	11.4	N 9 59.4	11.7	57.8	60	06 24	07 17	08 07	23 29	24 59	00 59	02 31
07	288 44.3	09.2	19 51.6	11.5	9 47.7	11.8	57.8	N 58	06 19	07 08	07 54	23 33	24 59	00 59	02 29
08	303 44.2	09.8	34 22.1	11.5	9 35.9	11.8	57.8	56	06 15	07 01	07 44	23 36	25 00	01 00	02 26
F 09	318 44.0	. . 10.4	48 52.6	11.5	9 24.1	11.9	57.9	54	06 10	06 54	07 34	23 39	25 00	01 00	02 24
R 10	333 43.9	11.0	63 23.1	11.5	9 12.2	11.9	57.9	52	06 06	06 48	07 26	23 41	25 00	01 00	02 22
I 11	348 43.8	11.6	77 53.6	11.5	9 00.3	12.0	57.9	50	06 03	06 42	07 18	23 44	25 01	01 01	02 20
D 12	3 43.6	S19 12.2	92 24.1	11.5	N 8 48.3	12.1	58.0	45	05 54	06 30	07 02	23 49	25 01	01 01	02 16
A 13	18 43.5	12.8	106 54.6	11.4	8 36.2	12.1	58.0	N 40	05 47	06 20	06 49	23 53	25 02	01 02	02 12
Y 14	33 43.4	13.4	121 25.0	11.5	8 24.1	12.2	58.0	35	05 40	06 11	06 38	23 57	25 02	01 02	02 09
15	48 43.3	. . 14.0	135 55.5	11.5	8 11.9	12.3	58.1	30	05 33	06 02	06 28	24 00	00 00	01 02	02 07
16	63 43.1	14.6	150 26.0	11.5	7 59.6	12.3	58.1	20	05 21	05 48	06 11	24 06	00 06	01 03	02 02
17	78 43.0	15.2	164 56.5	11.5	7 47.3	12.3	58.1	N 10	05 08	05 34	05 56	24 10	00 10	01 04	01 59
18	93 42.9	S19 15.8	179 27.0	11.4	N 7 35.0	12.4	58.2	0	04 54	05 20	05 42	24 15	00 15	01 04	01 55
19	108 42.7	16.4	193 57.4	11.5	7 22.6	12.5	58.2	S 10	04 39	05 05	05 27	24 20	00 20	01 05	01 52
20	123 42.6	16.9	208 27.9	11.5	7 10.1	12.5	58.2	20	04 20	04 48	05 12	24 25	00 25	01 06	01 48
21	138 42.5	. . 17.5	222 58.4	11.4	6 57.6	12.5	58.3	30	03 56	04 28	04 54	24 30	00 30	01 06	01 44
22	153 42.3	18.1	237 28.8	11.5	6 45.1	12.6	58.3	35	03 41	04 16	04 44	24 33	00 33	01 07	01 41
23	168 42.2	18.7	251 59.3	11.4	6 32.5	12.7	58.3	40	03 23	04 01	04 32	00 06	00 37	01 07	01 39
19 00	183 42.1	S19 19.3	266 29.7	11.4	N 6 19.8	12.6	58.4	45	02 59	03 43	04 18	00 13	00 41	01 08	01 36
01	198 41.9	19.9	281 00.1	11.5	6 07.2	12.8	58.4	S 50	02 27	03 20	04 00	00 22	00 46	01 09	01 32
02	213 41.8	20.5	295 30.6	11.4	5 54.4	12.8	58.4	52	02 10	03 09	03 52	00 26	00 48	01 09	01 30
03	228 41.7	. . 21.1	310 01.0	11.4	5 41.6	12.8	58.4	54	01 49	02 56	03 43	00 31	00 51	01 09	01 29
04	243 41.5	21.7	324 31.4	11.4	5 28.8	12.9	58.5	56	01 21	02 41	03 32	00 36	00 54	01 10	01 27
05	258 41.4	22.3	339 01.8	11.3	5 15.9	12.9	58.5	58	00 34	02 23	03 20	00 42	00 57	01 10	01 24
06	273 41.2	S19 22.8	353 32.1	11.4	N 5 03.0	12.9	58.5	S 60	////	02 01	03 06	00 48	01 00	01 11	01 22
07	288 41.1	23.4	8 02.5	11.3	4 50.1	13.0	58.6								
S 08	303 41.0	24.0	22 32.8	11.3	4 37.1	13.1	58.6								
A 09	318 40.8	. . 24.6	37 03.1	11.3	4 24.0	13.0	58.6								
T 10	333 40.7	25.2	51 33.4	11.3	4 11.0	13.1	58.7								
U 11	348 40.6	25.8	66 03.7	11.3	3 57.9	13.2	58.7								
R 12	3 40.4	S19 26.3	80 34.0	11.3	N 3 44.7	13.2	58.7								
D 13	18 40.3	26.9	95 04.3	11.2	3 31.5	13.2	58.8								
A 14	33 40.1	27.5	109 34.5	11.2	3 18.3	13.2	58.8								
Y 15	48 40.0	. . 28.1	124 04.7	11.2	3 05.1	13.3	58.8								
16	63 39.9	28.7	138 34.9	11.1	2 51.8	13.3	58.9								
17	78 39.7	29.3	153 05.0	11.2	2 38.5	13.3	58.9								
18	93 39.6	S19 29.8	167 35.2	11.1	N 2 25.2	13.4	58.9								
19	108 39.4	30.4	182 05.3	11.1	2 11.8	13.4	59.0								
20	123 39.3	31.0	196 35.4	11.0	1 58.4	13.4	59.0								
21	138 39.2	. . 31.6	211 05.4	11.1	1 45.0	13.4	59.0								
22	153 39.0	32.1	225 35.5	11.0	1 31.6	13.5	59.1								
23	168 38.9	32.7	240 05.5	10.9	1 18.1	13.4	59.1								
20 00	183 38.7	S19 33.3	254 35.4	11.0	N 1 04.7	13.5	59.1								
01	198 38.6	33.9	269 05.4	10.9	0 51.2	13.6	59.1								
02	213 38.4	34.4	283 35.3	10.8	0 37.6	13.5	59.2								
03	228 38.3	. . 35.0	298 05.1	10.9	0 24.1	13.5	59.2								
04	243 38.2	35.6	312 35.0	10.8	N 0 10.6	13.6	59.2								
05	258 38.0	36.2	327 04.8	10.8	S 0 03.0	13.6	59.3								
06	273 37.9	S19 36.7	341 34.6	10.7	S 0 16.6	13.6	59.3								
07	288 37.7	37.3	356 04.3	10.7	0 30.2	13.6	59.3								
08	303 37.6	37.9	10 34.0	10.6	0 43.8	13.6	59.4								
S 09	318 37.4	. . 38.4	25 03.6	10.7	0 57.4	13.7	59.4								
U 10	333 37.3	39.0	39 33.3	10.5	1 11.1	13.6	59.4								
N 11	348 37.1	39.6	54 02.8	10.6	1 24.7	13.6	59.5								
D 12	3 37.0	S19 40.2	68 32.4	10.5	S 1 38.3	13.7	59.5								
A 13	18 36.8	40.7	83 01.9	10.4	1 52.0	13.6	59.5								
Y 14	33 36.7	41.3	97 31.3	10.4	2 05.6	13.7	59.5								
15	48 36.5	. . 41.9	112 00.7	10.4	2 19.3	13.7	59.6								
16	63 36.4	42.4	126 30.1	10.3	2 33.0	13.6	59.6								
17	78 36.2	43.0	140 59.4	10.2	2 46.6	13.7	59.6								
18	93 36.1	S19 43.6	155 28.6	10.3	S 3 00.3	13.6	59.7								
19	108 35.9	44.1	169 57.9	10.1	3 13.9	13.7	59.7								
20	123 35.8	44.7	184 27.0	10.1	3 27.6	13.6	59.7								
21	138 35.6	. . 45.2	198 56.1	10.1	3 41.2	13.7	59.7								
22	153 35.5	45.8	213 25.2	10.0	3 54.9	13.6	59.8								
23	168 35.3	46.4	227 54.2	10.0	S 4 08.5	13.6	59.8								
	SD 16.2	d 0.6	SD	15.8	16.0		16.2								

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	18	19	20	21
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	14 38	16 17	13 41	13 21	13 03	12 43
N 70	13 15	15 04	16 29	13 29	13 17	13 05	12 53
68	14 00	15 24	16 39	13 19	13 13	13 08	13 02
66	14 29	15 40	16 47	13 10	13 10	13 10	13 09
64	14 51	15 53	16 54	13 03	13 07	13 11	13 15
62	15 09	16 04	17 00	12 57	13 05	13 13	13 21
60	15 23	16 13	17 06	12 52	13 03	13 14	13 25
N 58	15 35	16 22	17 11	12 47	13 01	13 15	13 29
56	15 46	16 29	17 15	12 43	13 00	13 16	13 33
54	15 56	16 36	17 20	12 39	12 58	13 17	13 37
52	16 04	16 42	17 24	12 36	12 57	13 18	13 40
50	16 12	16 48	17 27	12 33	12 56	13 18	13 42
45	16 28	17 00	17 36	12 26	12 53	13 20	13 48
N 40	16 41	17 10	17 43	12 20	12 51	13 21	13 53
35	16 52	17 20	17 50	12 15	12 49	13 22	13 58
30	17 02	17 28	17 57	12 11	12 47	13 23	14 02
20	17 20	17 43	18 10	12 03	12 44	13 25	14 08
N 10	17 35	17 57	18 23	11 56	12 41	13 27	14 14
0	17 49	18 11	18 36	11 49	12 38	13 28	14 20
S 10	18 03	18 26	18 52	11 43	12 36	13 30	14 25
20	18 19	18 43	19 11	11 36	12 33	13 31	14 31
30	18 37	19 03	19 35	11 28	12 30	13 33	14 38
35	18 47	19 16	19 50	11 23	12 28	13 34	14 42
40	18 59	19 30	20 09	11 18	12 26	13 35	14 47
45	19 14	19 48	20 33	11 12	12 23	13 36	14 52
S 50	19 31	20 11	21 05	11 04	12 20	13 38	14 58
52	19 40	20 23	21 23	11 01	12 19	13 38	15 01
54	19 49	20 36	21 44	10 57	12 17	13 39	15 04
56	20 00	20 51	22 13	10 53	12 15	13 40	15 08
58	20 12	21 09	23 05	10 48	12 13	13 41	15 12
S 60	20 26	21 32	////	10 43	12 11	13 42	15 16

Day	SUN			MOON				
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase	
	00^h	12^h		Upper	Lower			
d	m s	m s	h m	h m	h m	d	%	
18	15 01	14 55	11 45	05 38	18 02	23	52	
19	14 49	14 42	11 45	06 27	18 51	24	41	
20	14 35	14 28	11 46	07 16	19 42	25	30	

UT	ARIES	VENUS −3.9		MARS +0.9		JUPITER −2.8		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
21 00	59 39.2	157 10.9	S24 20.8	262 15.8	N11 35.5	28 57.4	N10 57.8	215 57.3	S 7 25.2
01	74 41.6	172 10.0	21.0	277 17.2	35.1	44 00.1	57.7	230 59.5	25.3
02	89 44.1	187 09.0	21.3	292 18.5	34.7	59 02.9	57.6	246 01.7	25.4
03	104 46.5	202 08.1	21.5	307 19.8	34.3	74 05.6	57.5	261 03.9	25.5
04	119 49.0	217 07.2	21.8	322 21.1	33.9	89 08.3	57.4	276 06.1	25.6
05	134 51.5	232 06.2	22.1	337 22.5	33.6	104 11.0	57.3	291 08.3	25.7
06	149 53.9	247 05.3	S24 22.3	352 23.8	N11 33.2	119 13.8	N10 57.3	306 10.5	S 7 25.8
07	164 56.4	262 04.4	22.5	7 25.1	32.8	134 16.5	57.2	321 12.7	25.9
08	179 58.9	277 03.4	22.8	22 26.4	32.4	149 19.2	57.1	336 14.9	26.0
M 09	195 01.3	292 02.5	23.0	37 27.8	32.0	164 21.9	57.0	351 17.2	26.1
O 10	210 03.8	307 01.6	23.3	52 29.1	31.6	179 24.7	56.9	6 19.4	26.2
N 11	225 06.3	322 00.6	23.5	67 30.4	31.2	194 27.4	56.8	21 21.6	26.3
D 12	240 08.7	336 59.7	S24 23.8	82 31.8	N11 30.8	209 30.1	N10 56.8	36 23.8	S 7 26.4
A 13	255 11.2	351 58.8	24.0	97 33.1	30.5	224 32.8	56.7	51 26.0	26.5
Y 14	270 13.7	6 57.8	24.2	112 34.4	30.1	239 35.6	56.6	66 28.2	26.6
15	285 16.1	21 56.9	24.5	127 35.8	29.7	254 38.3	56.5	81 30.4	26.6
16	300 18.6	36 56.0	24.7	142 37.1	29.3	269 41.0	56.4	96 32.6	26.7
17	315 21.0	51 55.0	24.9	157 38.4	28.9	284 43.7	56.3	111 34.8	26.8
18	330 23.5	66 54.1	S24 25.2	172 39.7	N11 28.5	299 46.5	N10 56.3	126 37.0	S 7 26.9
19	345 26.0	81 53.2	25.4	187 41.1	28.1	314 49.2	56.2	141 39.2	27.0
20	0 28.4	96 52.2	25.6	202 42.4	27.8	329 51.9	56.1	156 41.4	27.1
21	15 30.9	111 51.3	25.9	217 43.7	27.4	344 54.6	56.0	171 43.7	27.2
22	30 33.4	126 50.4	26.1	232 45.1	27.0	359 57.3	55.9	186 45.9	27.3
23	45 35.8	141 49.4	26.3	247 46.4	26.6	15 00.1	55.8	201 48.1	27.4
22 00	60 38.3	156 48.5	S24 26.6	262 47.7	N11 26.2	30 02.8	N10 55.8	216 50.3	S 7 27.5
01	75 40.8	171 47.5	26.8	277 49.1	25.8	45 05.5	55.7	231 52.5	27.6
02	90 43.2	186 46.6	27.0	292 50.4	25.4	60 08.2	55.6	246 54.7	27.7
03	105 45.7	201 45.7	27.2	307 51.7	25.1	75 10.9	55.5	261 56.9	27.8
04	120 48.1	216 44.7	27.4	322 53.1	24.7	90 13.7	55.4	276 59.1	27.9
05	135 50.6	231 43.8	27.7	337 54.4	24.3	105 16.4	55.4	292 01.3	28.0
06	150 53.1	246 42.9	S24 27.9	352 55.8	N11 23.9	120 19.1	N10 55.3	307 03.5	S 7 28.0
07	165 55.5	261 41.9	28.1	7 57.1	23.5	135 21.8	55.2	322 05.7	28.1
T 08	180 58.0	276 41.0	28.3	22 58.4	23.1	150 24.6	55.1	337 08.0	28.2
U 09	196 00.5	291 40.0	28.5	37 59.8	22.8	165 27.3	55.0	352 10.2	28.3
E 10	211 02.9	306 39.1	28.7	53 01.1	22.4	180 30.0	54.9	7 12.4	28.4
S 11	226 05.4	321 38.2	28.9	68 02.4	22.0	195 32.7	54.9	22 14.6	28.5
D 12	241 07.9	336 37.2	S24 29.2	83 03.8	N11 21.6	210 35.4	N10 54.8	37 16.8	S 7 28.6
A 13	256 10.3	351 36.3	29.4	98 05.1	21.2	225 38.1	54.7	52 19.0	28.7
Y 14	271 12.8	6 35.4	29.6	113 06.5	20.8	240 40.9	54.6	67 21.2	28.8
15	286 15.3	21 34.4	29.8	128 07.8	20.4	255 43.6	54.5	82 23.4	28.9
16	301 17.7	36 33.5	30.0	143 09.1	20.1	270 46.3	54.5	97 25.6	29.0
17	316 20.2	51 32.5	30.2	158 10.5	19.7	285 49.0	54.4	112 27.8	29.1
18	331 22.6	66 31.6	S24 30.4	173 11.8	N11 19.3	300 51.7	N10 54.3	127 30.1	S 7 29.2
19	346 25.1	81 30.7	30.6	188 13.2	18.9	315 54.5	54.2	142 32.3	29.2
20	1 27.6	96 29.7	30.8	203 14.5	18.5	330 57.2	54.1	157 34.5	29.3
21	16 30.0	111 28.8	31.0	218 15.9	18.1	345 59.9	54.1	172 36.7	29.4
22	31 32.5	126 27.8	31.2	233 17.2	17.8	1 02.6	54.0	187 38.9	29.5
23	46 35.0	141 26.9	31.4	248 18.5	17.4	16 05.3	53.9	202 41.1	29.6
23 00	61 37.4	156 26.0	S24 31.6	263 19.9	N11 17.0	31 08.0	N10 53.8	217 43.3	S 7 29.7
01	76 39.9	171 25.0	31.8	278 21.2	16.6	46 10.8	53.7	232 45.5	29.8
02	91 42.4	186 24.1	32.0	293 22.6	16.2	61 13.5	53.7	247 47.7	29.9
03	106 44.8	201 23.1	32.2	308 23.9	15.8	76 16.2	53.6	262 50.0	30.0
04	121 47.3	216 22.2	32.3	323 25.3	15.5	91 18.9	53.5	277 52.2	30.1
05	136 49.8	231 21.2	32.5	338 26.6	15.1	106 21.6	53.4	292 54.4	30.2
06	151 52.2	246 20.3	S24 32.7	353 28.0	N11 14.7	121 24.3	N10 53.3	307 56.6	S 7 30.3
W 07	166 54.7	261 19.4	32.9	8 29.3	14.3	136 27.0	53.3	322 58.8	30.4
E 08	181 57.1	276 18.4	33.1	23 30.7	13.9	151 29.8	53.2	338 01.0	30.4
D 09	196 59.6	291 17.5	33.3	38 32.0	13.5	166 32.5	53.1	353 03.2	30.5
N 10	212 02.1	306 16.5	33.5	53 33.4	13.2	181 35.2	53.0	8 05.4	30.6
E 11	227 04.5	321 15.6	33.6	68 34.7	12.8	196 37.9	52.9	23 07.6	30.7
S 12	242 07.0	336 14.7	S24 33.8	83 36.0	N11 12.4	211 40.6	N10 52.9	38 09.9	S 7 30.8
D 13	257 09.5	351 13.7	34.0	98 37.4	12.0	226 43.3	52.8	53 12.1	30.9
A 14	272 11.9	6 12.8	34.2	113 38.7	11.6	241 46.0	52.7	68 14.3	31.0
Y 15	287 14.4	21 11.8	34.3	128 40.1	11.3	256 48.8	52.6	83 16.5	31.1
16	302 16.9	36 10.9	34.5	143 41.4	10.9	271 51.5	52.5	98 18.7	31.2
17	317 19.3	51 09.9	34.7	158 42.8	10.5	286 54.2	52.5	113 20.9	31.3
18	332 21.8	66 09.0	S24 34.9	173 44.2	N11 10.1	301 56.9	N10 52.4	128 23.1	S 7 31.4
19	347 24.2	81 08.1	35.0	188 45.5	09.7	316 59.6	52.3	143 25.3	31.5
20	2 26.7	96 07.1	35.2	203 46.9	09.4	332 02.3	52.2	158 27.6	31.5
21	17 29.2	111 06.2	35.4	218 48.2	09.0	347 05.0	52.2	173 29.8	31.6
22	32 31.6	126 05.2	35.5	233 49.6	08.6	2 07.7	52.1	188 32.0	31.7
23	47 34.1	141 04.3	35.7	248 50.9	08.2	17 10.5	52.0	203 34.2	31.8
	h m								
Mer. Pass.	19 54.2	v −0.9	d 0.2	v 1.3	d 0.4	v 2.7	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.7	S40 15.4
Achernar	335 27.1	S57 10.7
Acrux	173 11.0	S63 09.7
Adhara	255 13.1	S28 59.2
Aldebaran	290 50.3	N16 32.0
Alioth	166 22.0	N55 53.5
Alkaid	153 00.2	N49 15.1
Al Na'ir	27 45.1	S46 54.3
Alnilam	275 47.2	S 1 11.7
Alphard	217 57.1	S 8 42.6
Alphecca	126 12.3	N26 40.5
Alpheratz	357 44.5	N29 09.7
Altair	62 09.5	N 8 54.2
Ankaa	353 16.5	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.1	N19 07.2
Atria	107 31.4	S69 02.9
Avior	234 18.2	S59 32.7
Bellatrix	278 32.9	N 6 21.6
Betelgeuse	271 02.2	N 7 24.5
Canopus	263 56.2	S52 42.0
Capella	280 35.6	N46 00.5
Deneb	49 32.4	N45 19.8
Denebola	182 34.9	N14 30.2
Diphda	348 56.8	S17 55.2
Dubhe	193 53.2	N61 40.8
Elnath	278 13.7	N28 37.0
Eltanin	90 47.1	N51 29.5
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.1	S29 33.5
Gacrux	172 02.6	S57 10.6
Gienah	175 53.6	S17 36.4
Hadar	148 50.1	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.1	N74 06.3
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.3	S36 25.6
Miaplacidus	221 39.7	S69 45.7
Mirfak	308 41.5	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.2	S56 41.9
Pollux	243 28.9	N27 59.6
Procyon	245 00.7	N 5 11.6
Rasalhague	96 07.8	N12 33.3
Regulus	207 44.7	N11 54.4
Rigel	281 12.8	S 8 11.3
Rigil Kent.	139 53.9	S60 52.9
Sabik	102 14.2	S15 44.3
Schedar	349 41.5	N56 36.5
Shaula	96 23.8	S37 06.7
Sirius	258 34.4	S16 43.9
Spica	158 32.7	S11 13.4
Suhail	222 53.2	S43 28.7
Vega	80 40.1	N38 48.0
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	96 10.2	13 34
Mars	202 09.5	6 28
Jupiter	329 24.5	21 56
Saturn	156 12.0	9 31

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
21 00	183 35.2	S19 46.9	242 23.2	9.9	S 4 22.1	13.6	59.8
01	198 35.0	47.5	256 52.1	9.8	4 35.7	13.6	59.9
02	213 34.9	48.0	271 20.9	9.8	4 49.3	13.6	59.9
03	228 34.7	. . 48.6	285 49.7	9.8	5 02.9	13.6	59.9
04	243 34.6	49.2	300 18.5	9.7	5 16.5	13.5	59.9
05	258 34.4	49.7	314 47.2	9.6	5 30.0	13.5	60.0
06	273 34.3	S19 50.3	329 15.8	9.5	S 5 43.5	13.5	60.0
07	288 34.1	50.8	343 44.3	9.5	5 57.0	13.5	60.0
08	303 34.0	51.4	358 12.8	9.5	6 10.5	13.5	60.0
M 09	318 33.8	. . 51.9	12 41.3	9.4	6 24.0	13.4	60.1
O 10	333 33.7	52.5	27 09.7	9.3	6 37.4	13.5	60.1
N 11	348 33.5	53.1	41 38.0	9.3	6 50.9	13.3	60.1
D 12	3 33.3	S19 53.6	56 06.3	9.1	S 7 04.2	13.4	60.1
A 13	18 33.2	54.2	70 34.4	9.2	7 17.6	13.3	60.2
Y 14	33 33.0	54.7	85 02.6	9.0	7 30.9	13.3	60.2
15	48 32.9	. . 55.3	99 30.6	9.0	7 44.2	13.3	60.2
16	63 32.7	55.8	113 58.6	9.0	7 57.5	13.2	60.2
17	78 32.6	56.4	128 26.6	8.8	8 10.7	13.2	60.3
18	93 32.4	S19 56.9	142 54.4	8.8	S 8 23.9	13.1	60.3
19	108 32.2	57.5	157 22.2	8.7	8 37.0	13.1	60.3
20	123 32.1	58.0	171 49.9	8.7	8 50.1	13.1	60.3
21	138 31.9	. . 58.6	186 17.6	8.6	9 03.2	13.0	60.4
22	153 31.8	59.1	200 45.2	8.5	9 16.2	12.9	60.4
23	168 31.6	19 59.6	215 12.7	8.4	9 29.1	13.0	60.4
22 00	183 31.4	S20 00.2	229 40.1	8.4	S 9 42.1	12.8	60.4
01	198 31.3	00.7	244 07.5	8.3	9 54.9	12.9	60.4
02	213 31.1	01.3	258 34.8	8.2	10 07.8	12.7	60.5
03	228 31.0	. . 01.8	273 02.0	8.2	10 20.5	12.7	60.5
04	243 30.8	02.4	287 29.2	8.1	10 33.2	12.7	60.5
05	258 30.6	02.9	301 56.3	8.0	10 45.9	12.6	60.5
06	273 30.5	S20 03.5	316 23.3	7.9	S10 58.5	12.5	60.5
07	288 30.3	04.0	330 50.2	7.8	11 11.0	12.5	60.6
T 08	303 30.1	04.5	345 17.0	7.8	11 23.5	12.4	60.6
U 09	318 30.0	. . 05.1	359 43.8	7.7	11 35.9	12.4	60.6
E 10	333 29.8	05.6	14 10.5	7.6	11 48.3	12.3	60.6
S 11	348 29.7	06.2	28 37.1	7.6	12 00.6	12.2	60.6
D 12	3 29.5	S20 06.7	43 03.7	7.4	S12 12.8	12.1	60.7
A 13	18 29.3	07.2	57 30.1	7.4	12 24.9	12.1	60.7
Y 14	33 29.2	07.8	71 56.5	7.3	12 37.0	12.0	60.7
15	48 29.0	. . 08.3	86 22.8	7.3	12 49.0	11.9	60.7
16	63 28.8	08.8	100 49.1	7.1	13 00.9	11.8	60.7
17	78 28.7	09.4	115 15.2	7.1	13 12.7	11.8	60.7
18	93 28.5	S20 09.9	129 41.3	7.0	S13 24.5	11.7	60.7
19	108 28.3	10.4	144 07.3	6.9	13 36.2	11.6	60.8
20	123 28.2	11.0	158 33.2	6.8	13 47.8	11.5	60.8
21	138 28.0	. . 11.5	172 59.0	6.8	13 59.3	11.4	60.8
22	153 27.8	12.0	187 24.8	6.7	14 10.7	11.4	60.8
23	168 27.7	12.6	201 50.5	6.6	14 22.1	11.2	60.8
23 00	183 27.5	S20 13.1	216 16.1	6.5	S14 33.3	11.2	60.8
01	198 27.3	13.6	230 41.6	6.4	14 44.5	11.1	60.8
02	213 27.1	14.2	245 07.0	6.4	14 55.6	10.9	60.8
03	228 27.0	. . 14.7	259 32.4	6.3	15 06.5	10.9	60.9
04	243 26.8	15.2	273 57.7	6.2	15 17.4	10.8	60.9
05	258 26.6	15.7	288 22.9	6.1	15 28.2	10.7	60.9
06	273 26.5	S20 16.3	302 48.0	6.1	S15 38.9	10.6	60.9
W 07	288 26.3	16.8	317 13.1	5.9	15 49.5	10.4	60.9
E 08	303 26.1	17.3	331 38.0	5.9	15 59.9	10.4	60.9
D 09	318 26.0	. . 17.8	346 02.9	5.8	16 10.3	10.3	60.9
N 10	333 25.8	18.4	0 27.7	5.8	16 20.6	10.1	60.9
E 11	348 25.6	18.9	14 52.5	5.7	16 30.7	10.1	60.9
S 12	3 25.4	S20 19.4	29 17.2	5.5	S16 40.8	9.9	60.9
D 13	18 25.3	19.9	43 41.7	5.6	16 50.7	9.8	60.9
A 14	33 25.1	20.5	58 06.3	5.4	17 00.5	9.7	60.9
Y 15	48 24.9	. . 21.0	72 30.7	5.4	17 10.2	9.6	60.9
16	63 24.7	21.5	86 55.1	5.3	17 19.8	9.4	60.9
17	78 24.6	22.0	101 19.4	5.2	17 29.2	9.4	61.0
18	93 24.4	S20 22.5	115 43.6	5.2	S17 38.6	9.2	61.0
19	108 24.2	23.1	130 07.8	5.0	17 47.8	9.1	61.0
20	123 24.0	23.6	144 31.8	5.1	17 56.9	9.0	61.0
21	138 23.9	. . 24.1	158 55.9	4.9	18 05.9	8.8	61.0
22	153 23.7	24.6	173 19.8	4.9	18 14.7	8.7	61.0
23	168 23.5	25.1	187 43.7	4.8	S18 23.4	8.6	61.0
	SD 16.2	d 0.5	SD	16.4	16.5		16.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 21	Moonrise 22	Moonrise 23	Moonrise 24
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 22	09 06	▬	03 02	05 20	08 07	▬
N 70	07 10	08 37	10 41	02 54	05 01	07 21	▬
68	06 59	08 16	09 45	02 48	04 46	06 51	09 09
66	06 50	07 59	09 12	02 43	04 33	06 29	08 29
64	06 42	07 45	08 48	02 38	04 23	06 12	08 01
62	06 36	07 33	08 30	02 35	04 15	05 58	07 40
60	06 30	07 23	08 14	02 31	04 07	05 46	07 23
N 58	06 24	07 14	08 01	02 29	04 01	05 35	07 09
56	06 19	07 06	07 50	02 26	03 55	05 26	06 56
54	06 15	06 59	07 40	02 24	03 50	05 18	06 46
52	06 11	06 53	07 31	02 22	03 46	05 11	06 36
50	06 07	06 47	07 23	02 20	03 41	05 05	06 28
45	05 58	06 34	07 06	02 16	03 33	04 51	06 10
N 40	05 50	06 23	06 53	02 12	03 25	04 40	05 55
35	05 43	06 13	06 41	02 09	03 19	04 31	05 43
30	05 36	06 05	06 30	02 07	03 13	04 22	05 32
20	05 22	05 49	06 13	02 02	03 04	04 08	05 14
N 10	05 09	05 35	05 57	01 59	02 56	03 56	04 58
0	04 55	05 20	05 42	01 55	02 48	03 44	04 44
S 10	04 39	05 05	05 28	01 52	02 41	03 33	04 29
20	04 20	04 48	05 12	01 48	02 32	03 21	04 14
30	03 55	04 27	04 53	01 44	02 23	03 07	03 56
35	03 39	04 14	04 42	01 41	02 18	02 59	03 46
40	03 20	03 59	04 30	01 39	02 12	02 50	03 34
45	02 55	03 40	04 15	01 36	02 06	02 40	03 20
S 50	02 21	03 16	03 57	01 32	01 58	02 27	03 03
52	02 03	03 05	03 48	01 30	01 54	02 21	02 56
54	01 40	02 51	03 38	01 29	01 50	02 15	02 47
56	01 09	02 35	03 27	01 27	01 45	02 08	02 37
58	////	02 16	03 15	01 24	01 40	02 00	02 26
S 60	////	01 51	03 00	01 22	01 35	01 51	02 14

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 21	Moonset 22	Moonset 23	Moonset 24
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	14 25	16 09	12 43	12 17	11 30	▬
N 70	12 50	14 54	16 22	12 53	12 39	12 17	▬
68	13 46	15 16	16 32	13 02	12 56	12 48	12 37
66	14 19	15 33	16 41	13 09	13 10	13 11	13 17
64	14 43	15 47	16 49	13 15	13 21	13 30	13 46
62	15 02	15 58	16 56	13 21	13 31	13 45	14 07
60	15 17	16 09	17 02	13 25	13 39	13 58	14 25
N 58	15 30	16 17	17 07	13 29	13 47	14 09	14 40
56	15 42	16 25	17 12	13 33	13 53	14 19	14 53
54	15 52	16 32	17 17	13 37	13 59	14 27	15 04
52	16 01	16 39	17 21	13 40	14 05	14 35	15 13
50	16 08	16 45	17 25	13 42	14 09	14 42	15 22
45	16 25	16 58	17 34	13 48	14 20	14 57	15 41
N 40	16 39	17 09	17 42	13 53	14 29	15 09	15 56
35	16 51	17 18	17 49	13 58	14 36	15 20	16 09
30	17 01	17 27	17 56	14 02	14 43	15 29	16 21
20	17 19	17 43	18 10	14 08	14 55	15 45	16 40
N 10	17 35	17 57	18 23	14 14	15 05	15 59	16 57
0	17 50	18 12	18 37	14 20	15 14	16 12	17 13
S 10	18 05	18 27	18 53	14 25	15 24	16 25	17 29
20	18 21	18 45	19 13	14 31	15 34	16 39	17 46
30	18 39	19 06	19 38	14 38	15 46	16 56	18 05
35	18 50	19 19	19 54	14 42	15 53	17 05	18 17
40	19 03	19 34	20 13	14 47	16 01	17 16	18 30
45	19 18	19 53	20 38	14 52	16 10	17 29	18 46
S 50	19 36	20 17	21 12	14 58	16 21	17 44	19 05
52	19 45	20 29	21 31	15 01	16 26	17 51	19 14
54	19 55	20 42	21 54	15 04	16 31	18 00	19 24
56	20 06	20 59	22 28	15 08	16 38	18 09	19 36
58	20 19	21 18	////	15 12	16 45	18 19	19 49
S 60	20 34	21 43	////	15 16	16 53	18 31	20 05

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
21	14 21	14 14	11 46	08 07	20 34	26	20
22	14 06	13 58	11 46	09 01	21 29	27	11
23	13 50	13 42	11 46	09 58	22 28	28	5

UT	ARIES	VENUS −3.9		MARS +0.8		JUPITER −2.8		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
24 00	62 36.6	156 03.3	S24 35.9	263 52.3	N11 07.8	32 13.2	N10 51.9	218 36.4	S 7 31.9
01	77 39.0	171 02.4	36.0	278 53.6	07.4	47 15.9	51.8	233 38.6	32.0
02	92 41.5	186 01.4	36.2	293 55.0	07.1	62 18.6	51.8	248 40.8	32.1
03	107 44.0	201 00.5	36.3	308 56.3	06.7	77 21.3	51.7	263 43.0	32.2
04	122 46.4	215 59.6	36.5	323 57.7	06.3	92 24.0	51.6	278 45.3	32.3
05	137 48.9	230 58.6	36.7	338 59.0	05.9	107 26.7	51.5	293 47.5	32.4
06	152 51.4	245 57.7	S24 36.8	354 00.4	N11 05.5	122 29.4	N10 51.4	308 49.7	S 7 32.5
07	167 53.8	260 56.7	37.0	9 01.8	05.2	137 32.1	51.4	323 51.9	32.5
T 08	182 56.3	275 55.8	37.1	24 03.1	04.8	152 34.8	51.3	338 54.1	32.6
H 09	197 58.7	290 54.8	37.3	39 04.5	04.4	167 37.5	51.2	353 56.3	32.7
U 10	213 01.2	305 53.9	37.4	54 05.8	04.0	182 40.3	51.1	8 58.5	32.8
R 11	228 03.7	320 52.9	37.6	69 07.2	03.7	197 43.0	51.1	24 00.7	32.9
S 12	243 06.1	335 52.0	S24 37.7	84 08.5	N11 03.3	212 45.7	N10 51.0	39 03.0	S 7 33.0
D 13	258 08.6	350 51.0	37.9	99 09.9	02.9	227 48.4	50.9	54 05.2	33.1
A 14	273 11.1	5 50.1	38.0	114 11.3	02.5	242 51.1	50.8	69 07.4	33.2
Y 15	288 13.5	20 49.2	38.2	129 12.6	02.1	257 53.8	50.8	84 09.6	33.3
16	303 16.0	35 48.2	38.3	144 14.0	01.8	272 56.5	50.7	99 11.8	33.4
17	318 18.5	50 47.3	38.4	159 15.3	01.4	287 59.2	50.6	114 14.0	33.5
18	333 20.9	65 46.3	S24 38.6	174 16.7	N11 01.0	303 01.9	N10 50.5	129 16.2	S 7 33.5
19	348 23.4	80 45.4	38.7	189 18.1	00.6	318 04.6	50.5	144 18.5	33.6
20	3 25.9	95 44.4	38.9	204 19.4	11 00.2	333 07.3	50.4	159 20.7	33.7
21	18 28.3	110 43.5	39.0	219 20.8	10 59.9	348 10.0	50.3	174 22.9	33.8
22	33 30.8	125 42.5	39.1	234 22.2	59.5	3 12.7	50.2	189 25.1	33.9
23	48 33.2	140 41.6	39.3	249 23.5	59.1	18 15.4	50.1	204 27.3	34.0
25 00	63 35.7	155 40.6	S24 39.4	264 24.9	N10 58.7	33 18.1	N10 50.1	219 29.5	S 7 34.1
01	78 38.2	170 39.7	39.5	279 26.3	58.4	48 20.8	50.0	234 31.7	34.2
02	93 40.6	185 38.7	39.7	294 27.6	58.0	63 23.5	49.9	249 34.0	34.3
03	108 43.1	200 37.8	39.8	309 29.0	57.6	78 26.3	49.8	264 36.2	34.4
04	123 45.6	215 36.8	39.9	324 30.3	57.2	93 29.0	49.8	279 38.4	34.4
05	138 48.0	230 35.9	40.0	339 31.7	56.8	108 31.7	49.7	294 40.6	34.5
06	153 50.5	245 35.0	S24 40.2	354 33.1	N10 56.5	123 34.4	N10 49.6	309 42.8	S 7 34.6
07	168 53.0	260 34.0	40.3	9 34.4	56.1	138 37.1	49.5	324 45.0	34.7
08	183 55.4	275 33.1	40.4	24 35.8	55.7	153 39.8	49.5	339 47.2	34.8
F 09	198 57.9	290 32.1	40.5	39 37.2	55.3	168 42.5	49.4	354 49.5	34.9
R 10	214 00.4	305 31.2	40.7	54 38.6	55.0	183 45.2	49.3	9 51.7	35.0
I 11	229 02.8	320 30.2	40.8	69 39.9	54.6	198 47.9	49.2	24 53.9	35.1
D 12	244 05.3	335 29.3	S24 40.9	84 41.3	N10 54.2	213 50.6	N10 49.2	39 56.1	S 7 35.2
A 13	259 07.7	350 28.3	41.0	99 42.7	53.8	228 53.3	49.1	54 58.3	35.3
Y 14	274 10.2	5 27.4	41.1	114 44.0	53.5	243 56.0	49.0	70 00.5	35.3
15	289 12.7	20 26.4	41.2	129 45.4	53.1	258 58.7	48.9	85 02.7	35.4
16	304 15.1	35 25.5	41.3	144 46.8	52.7	274 01.4	48.9	100 05.0	35.5
17	319 17.6	50 24.5	41.5	159 48.1	52.3	289 04.1	48.8	115 07.2	35.6
18	334 20.1	65 23.6	S24 41.6	174 49.5	N10 51.9	304 06.8	N10 48.7	130 09.4	S 7 35.7
19	349 22.5	80 22.6	41.7	189 50.9	51.6	319 09.5	48.6	145 11.6	35.8
20	4 25.0	95 21.7	41.8	204 52.3	51.2	334 12.2	48.6	160 13.8	35.9
21	19 27.5	110 20.7	41.9	219 53.6	50.8	349 14.9	48.5	175 16.0	36.0
22	34 29.9	125 19.8	42.0	234 55.0	50.4	4 17.6	48.4	190 18.3	36.1
23	49 32.4	140 18.8	42.1	249 56.4	50.1	19 20.3	48.4	205 20.5	36.2
26 00	64 34.9	155 17.9	S24 42.2	264 57.8	N10 49.7	34 23.0	N10 48.3	220 22.7	S 7 36.2
01	79 37.3	170 16.9	42.3	279 59.1	49.3	49 25.7	48.2	235 24.9	36.3
02	94 39.8	185 16.0	42.4	295 00.5	48.9	64 28.4	48.1	250 27.1	36.4
03	109 42.2	200 15.0	42.5	310 01.9	48.6	79 31.1	48.1	265 29.3	36.5
04	124 44.7	215 14.1	42.6	325 03.3	48.2	94 33.8	48.0	280 31.6	36.6
05	139 47.2	230 13.1	42.7	340 04.6	47.8	109 36.5	47.9	295 33.8	36.7
06	154 49.6	245 12.2	S24 42.8	355 06.0	N10 47.4	124 39.2	N10 47.8	310 36.0	S 7 36.8
07	169 52.1	260 11.2	42.9	10 07.4	47.1	139 41.9	47.8	325 38.2	36.9
S 08	184 54.6	275 10.3	43.0	25 08.8	46.7	154 44.6	47.7	340 40.4	37.0
A 09	199 57.0	290 09.3	43.1	40 10.1	46.3	169 47.2	47.6	355 42.6	37.0
T 10	214 59.5	305 08.4	43.1	55 11.5	46.0	184 49.9	47.6	10 44.9	37.1
U 11	230 02.0	320 07.4	43.2	70 12.9	45.6	199 52.6	47.5	25 47.1	37.2
R 12	245 04.4	335 06.5	S24 43.3	85 14.3	N10 45.2	214 55.3	N10 47.4	40 49.3	S 7 37.3
D 13	260 06.9	350 05.5	43.4	100 15.7	44.8	229 58.0	47.3	55 51.5	37.4
A 14	275 09.3	5 04.6	43.5	115 17.0	44.5	245 00.7	47.3	70 53.7	37.5
Y 15	290 11.8	20 03.6	43.6	130 18.4	44.1	260 03.4	47.2	85 55.9	37.6
16	305 14.3	35 02.7	43.6	145 19.8	43.7	275 06.1	47.1	100 58.2	37.7
17	320 16.7	50 01.7	43.7	160 21.2	43.3	290 08.8	47.0	116 00.4	37.8
18	335 19.2	65 00.8	S24 43.8	175 22.6	N10 43.0	305 11.5	N10 47.0	131 02.6	S 7 37.8
19	350 21.7	79 59.8	43.9	190 23.9	42.6	320 14.2	46.9	146 04.8	37.9
20	5 24.1	94 58.9	44.0	205 25.3	42.2	335 16.9	46.8	161 07.0	38.0
21	20 26.6	109 57.9	44.0	220 26.7	41.8	350 19.6	46.8	176 09.2	38.1
22	35 29.1	124 57.0	44.1	235 28.1	41.5	5 22.3	46.7	191 11.5	38.2
23	50 31.5	139 56.0	44.2	250 29.5	41.1	20 25.0	46.6	206 13.7	38.3
	h m								
Mer. Pass.	19 42.4	v −0.9	d 0.1	v 1.4	d 0.4	v 2.7	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.7	S40 15.4
Achernar	335 27.1	S57 10.7
Acrux	173 11.0	S63 09.7
Adhara	255 13.1	S28 59.2
Aldebaran	290 50.3	N16 32.0
Alioth	166 22.0	N55 53.4
Alkaid	153 00.1	N49 15.1
Al Na'ir	27 45.1	S46 54.3
Alnilam	275 47.2	S 1 11.7
Alphard	217 57.1	S 8 42.6
Alphecca	126 12.3	N26 40.5
Alpheratz	357 44.5	N29 09.7
Altair	62 09.5	N 8 54.2
Ankaa	353 16.5	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.0	N19 07.2
Atria	107 31.4	S69 02.9
Avior	234 18.2	S59 32.7
Bellatrix	278 32.9	N 6 21.6
Betelgeuse	271 02.2	N 7 24.5
Canopus	263 56.2	S52 42.0
Capella	280 35.6	N46 00.5
Deneb	49 32.4	N45 19.8
Denebola	182 34.9	N14 30.2
Diphda	348 56.8	S17 55.2
Dubhe	193 53.1	N61 40.8
Elnath	278 13.7	N28 37.0
Eltanin	90 47.2	N51 29.5
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.1	S29 33.5
Gacrux	172 02.5	S57 10.6
Gienah	175 53.6	S17 36.4
Hadar	148 50.1	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.0	N74 06.3
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.7	S69 45.8
Mirfak	308 41.5	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.3	S56 41.9
Pollux	243 28.8	N27 59.6
Procyon	245 00.7	N 5 11.6
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.7	N11 54.4
Rigel	281 12.8	S 8 11.3
Rigil Kent.	139 53.9	S60 52.9
Sabik	102 14.2	S15 44.3
Schedar	349 41.5	N56 36.5
Shaula	96 23.8	S37 06.7
Sirius	258 34.4	S16 43.9
Spica	158 32.7	S11 13.4
Suhail	222 53.1	S43 28.7
Vega	80 40.1	N38 47.9
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	92 04.9	13 38
Mars	200 49.2	6 22
Jupiter	329 42.4	21 43
Saturn	155 53.8	9 21

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
24 00	183 23.3	S20 25.6	202 07.5	4.7	S18 32.0	8.5	61.0
01	198 23.2	26.1	216 31.2	4.7	18 40.5	8.3	61.0
02	213 23.0	26.7	230 54.9	4.6	18 48.8	8.2	61.0
03	228 22.8	27.2	245 18.5	4.6	18 57.0	8.1	61.0
04	243 22.6	27.7	259 42.1	4.5	19 05.1	7.9	61.0
05	258 22.4	28.2	274 05.6	4.4	19 13.0	7.8	61.0
06	273 22.3	S20 28.7	288 29.0	4.4	S19 20.8	7.6	61.0
07	288 22.1	29.2	302 52.4	4.3	19 28.4	7.5	60.9
T 08	303 21.9	29.7	317 15.7	4.3	19 35.9	7.4	60.9
H 09	318 21.7	30.2	331 39.0	4.2	19 43.3	7.2	60.9
U 10	333 21.5	30.7	346 02.2	4.2	19 50.5	7.1	60.9
R 11	348 21.4	31.3	0 25.4	4.1	19 57.6	6.9	60.9
S 12	3 21.2	S20 31.8	14 48.5	4.0	S20 04.5	6.8	60.9
D 13	18 21.0	32.3	29 11.5	4.0	20 11.3	6.6	60.9
A 14	33 20.8	32.8	43 34.5	4.0	20 17.9	6.5	60.9
Y 15	48 20.6	33.3	57 57.5	3.9	20 24.4	6.3	60.9
16	63 20.5	33.8	72 20.4	3.9	20 30.7	6.2	60.9
17	78 20.3	34.3	86 43.3	3.8	20 36.9	6.0	60.9
18	93 20.1	S20 34.8	101 06.1	3.8	S20 42.9	5.9	60.9
19	108 19.9	35.3	115 28.9	3.7	20 48.8	5.7	60.9
20	123 19.7	35.8	129 51.6	3.8	20 54.5	5.6	60.9
21	138 19.5	36.3	144 14.4	3.6	21 00.1	5.4	60.8
22	153 19.4	36.8	158 37.0	3.7	21 05.5	5.2	60.8
23	168 19.2	37.3	172 59.7	3.6	21 10.7	5.1	60.8
25 00	183 19.0	S20 37.8	187 22.3	3.6	S21 15.8	5.0	60.8
01	198 18.8	38.3	201 44.9	3.6	21 20.8	4.8	60.8
02	213 18.6	38.8	216 07.5	3.5	21 25.6	4.6	60.8
03	228 18.4	39.3	230 30.0	3.5	21 30.2	4.4	60.8
04	243 18.2	39.8	244 52.5	3.5	21 34.6	4.3	60.7
05	258 18.1	40.3	259 15.0	3.5	S21 38.9	4.2	60.7
06	273 17.9	S20 40.8					
07	288 17.7	41.3					
08	303 17.5	41.8					
F 09	318 17.3	42.3					
R 10	333 17.1	42.7					
I 11	348 16.9	43.2					
D 12	3 16.7	S20 43.7	359 52.1	3.4	S22 04.4	3.0	60.6
A 13	18 16.5	44.2	14 14.5	3.4	22 07.4	2.9	60.6
Y 14	33 16.4	44.7	28 36.9	3.4	22 10.3	2.6	60.6
15	48 16.2	45.2	42 59.3	3.4	22 12.9	2.5	60.6
16	63 16.0	45.7	57 21.7	3.4	22 15.4	2.4	60.5
17	78 15.8	46.2	71 44.1	3.4	22 17.8	2.1	60.5
18	93 15.6	S20 46.7	86 06.5	3.4	S22 19.9	2.0	60.5
19	108 15.4	47.1	100 28.9	3.4	22 21.9	1.8	60.5
20	123 15.2	47.6	114 51.3	3.5	22 23.7	1.7	60.4
21	138 15.0	48.1	129 13.8	3.5	22 25.4	1.5	60.4
22	153 14.8	48.6	143 36.3	3.4	22 26.9	1.4	60.4
23	168 14.6	49.1	157 58.7	3.6	22 28.3	1.1	60.4
26 00	183 14.4	S20 49.6	172 21.3	3.5	S22 29.4	1.0	60.4
01	198 14.3	50.0	186 43.8	3.5	22 30.4	0.9	60.3
02	213 14.1	50.5	201 06.3	3.6	22 31.3	0.6	60.3
03	228 13.9	51.0	215 28.9	3.6	22 31.9	0.6	60.3
04	243 13.7	51.5	229 51.5	3.7	22 32.5	0.3	60.3
05	258 13.5	52.0	244 14.2	3.6	22 32.8	0.2	60.2
06	273 13.3	S20 52.4	258 36.8	3.7	S22 33.0	0.0	60.2
07	288 13.1	52.9	272 59.5	3.8	22 33.0	0.1	60.2
S 08	303 12.9	53.4	287 22.3	3.8	22 32.9	0.3	60.1
A 09	318 12.7	53.9	301 45.1	3.8	22 32.6	0.5	60.1
T 10	333 12.5	54.4	316 07.9	3.9	22 32.1	0.6	60.1
U 11	348 12.3	54.8	330 30.8	3.9	22 31.5	0.8	60.1
R 12	3 12.1	S20 55.3	344 53.7	4.0	S22 30.7	0.9	60.0
D 13	18 11.9	55.8	359 16.7	4.0	22 29.8	1.2	60.0
A 14	33 11.7	56.3	13 39.7	4.0	22 28.6	1.2	60.0
Y 15	48 11.5	56.7	28 02.7	4.2	22 27.4	1.4	59.9
16	63 11.3	57.2	42 25.9	4.1	22 26.0	1.6	59.9
17	78 11.1	57.7	56 49.0	4.3	22 24.4	1.8	59.9
18	93 10.9	S20 58.1	71 12.3	4.3	S22 22.6	1.8	59.9
19	108 10.7	58.6	85 35.6	4.3	22 20.8	2.1	59.8
20	123 10.5	59.1	99 58.9	4.4	22 18.7	2.2	59.8
21	138 10.3	20 59.5	114 22.3	4.5	22 16.5	2.3	59.8
22	153 10.1	21 00.0	128 45.8	4.6	22 14.2	2.5	59.7
23	168 09.9	S21 00.5	143 09.4	4.6	S22 11.7	2.7	59.7
	SD 16.2	d 0.5	SD	16.6		16.5	16.4

A partial eclipse of the Sun occurs on this date. See page 5.

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 24	Moonrise 25	Moonrise 26	Moonrise 27
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 32	09 20	▬	▬	▬	▬	▬
N 70	07 18	08 48	11 22	▬	▬	▬	▬
68	07 07	08 25	10 01	09 09	▬	▬	13 10
66	06 57	08 07	09 24	08 29	10 21	11 39	12 09
64	06 49	07 52	08 58	08 01	09 41	10 54	11 35
62	06 42	07 40	08 37	07 40	09 13	10 24	11 10
60	06 35	07 29	08 21	07 23	08 51	10 01	10 50
N 58	06 29	07 20	08 07	07 09	08 34	09 43	10 33
56	06 24	07 11	07 55	06 56	08 19	09 28	10 19
54	06 19	07 04	07 45	06 46	08 06	09 14	10 07
52	06 15	06 57	07 36	06 36	07 55	09 03	09 57
50	06 11	06 51	07 28	06 28	07 45	08 53	09 47
45	06 01	06 38	07 10	06 10	07 25	08 31	09 27
N 40	05 53	06 26	06 56	05 55	07 08	08 14	09 10
35	05 45	06 16	06 44	05 43	06 54	07 59	08 57
30	05 38	06 07	06 33	05 32	06 41	07 46	08 45
20	05 24	05 51	06 15	05 14	06 21	07 25	08 24
N 10	05 10	05 36	05 58	04 58	06 02	07 06	08 06
0	04 55	05 21	05 43	04 44	05 46	06 48	07 49
S 10	04 39	05 05	05 28	04 29	05 29	06 31	07 32
20	04 19	04 47	05 11	04 14	05 11	06 12	07 15
30	03 54	04 26	04 52	03 56	04 51	05 51	06 54
35	03 37	04 12	04 41	03 46	04 39	05 38	06 42
40	03 17	03 57	04 28	03 34	04 25	05 23	06 28
45	02 52	03 37	04 13	03 20	04 09	05 06	06 11
S 50	02 16	03 13	03 54	03 03	03 49	04 45	05 51
52	01 57	03 00	03 45	02 56	03 40	04 35	05 41
54	01 32	02 46	03 35	02 47	03 29	04 24	05 30
56	00 55	02 29	03 23	02 37	03 17	04 11	05 18
58	////	02 09	03 10	02 26	03 04	03 56	05 04
S 60	////	01 42	02 54	02 14	02 48	03 38	04 47

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 24	Moonset 25	Moonset 26	Moonset 27
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	14 13	16 01	▬	▬	▬	▬
N 70	12 11	14 45	16 15	▬	▬	▬	▬
68	13 32	15 08	16 26	12 37	▬	▬	15 05
66	14 10	15 26	16 36	13 17	13 36	14 29	16 04
64	14 36	15 41	16 44	13 46	14 16	15 14	16 38
62	14 56	15 54	16 51	14 07	14 44	15 43	17 03
60	15 12	16 04	16 58	14 25	15 06	16 06	17 23
N 58	15 26	16 14	17 04	14 40	15 24	16 24	17 39
56	15 38	16 22	17 09	14 53	15 39	16 40	17 52
54	15 48	16 29	17 14	15 04	15 52	16 53	18 04
52	15 57	16 36	17 18	15 13	16 03	17 04	18 15
50	16 06	16 42	17 23	15 22	16 13	17 14	18 24
45	16 23	16 56	17 32	15 41	16 34	17 36	18 44
N 40	16 38	17 07	17 41	15 56	16 51	17 53	18 59
35	16 50	17 17	17 48	16 09	17 06	18 08	19 13
30	17 01	17 26	17 56	16 21	17 18	18 20	19 24
20	17 19	17 43	18 10	16 40	17 40	18 42	19 44
N 10	17 35	17 58	18 24	16 57	17 58	19 00	20 01
0	17 51	18 13	18 38	17 13	18 15	19 18	20 17
S 10	18 06	18 29	18 55	17 29	18 33	19 35	20 33
20	18 23	18 47	19 15	17 46	18 51	19 53	20 50
30	18 42	19 08	19 41	18 05	19 13	20 15	21 09
35	18 53	19 22	19 57	18 17	19 25	20 27	21 21
40	19 06	19 38	20 17	18 30	19 40	20 41	21 34
45	19 22	19 57	20 43	18 46	19 57	20 58	21 49
S 50	19 41	20 22	21 19	19 05	20 18	21 19	22 07
52	19 50	20 35	21 39	19 14	20 28	21 29	22 16
54	20 00	20 49	22 04	19 24	20 39	21 40	22 26
56	20 12	21 06	22 43	19 36	20 52	21 52	22 37
58	20 25	21 27	////	19 49	21 07	22 07	22 49
S 60	20 41	21 54	////	20 05	21 25	22 24	23 04

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
24	13 34	13 25	11 47	10 58	23 29	29	1
25	13 16	13 07	11 47	12 01	24 32	00	0
26	12 58	12 49	11 47	13 03	00 32	01	2

UT	ARIES	VENUS −3.9		MARS +0.8		JUPITER −2.8		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
27 00	65 34.0	154 55.1	S24 44.2	265 30.9	N10 40.7	35 27.7	N10 46.5	221 15.9	S 7 38.4
01	80 36.5	169 54.1	44.3	280 32.3	40.4	50 30.3	46.5	236 18.1	38.5
02	95 38.9	184 53.2	44.4	295 33.6	40.0	65 33.0	46.4	251 20.3	38.6
03	110 41.4	199 52.2	44.4	310 35.0	39.6	80 35.7	46.3	266 22.6	38.6
04	125 43.8	214 51.3	44.5	325 36.4	39.2	95 38.4	46.3	281 24.8	38.7
05	140 46.3	229 50.3	44.6	340 37.8	38.9	110 41.1	46.2	296 27.0	38.8
06	155 48.8	244 49.4	S24 44.6	355 39.2	N10 38.5	125 43.8	N10 46.1	311 29.2	S 7 38.9
07	170 51.2	259 48.4	44.7	10 40.6	38.1	140 46.5	46.1	326 31.4	39.0
08	185 53.7	274 47.5	44.8	25 42.0	37.8	155 49.2	46.0	341 33.6	39.1
S 09	200 56.2	289 46.5	44.8	40 43.3	37.4	170 51.9	45.9	356 35.9	39.2
U 10	215 58.6	304 45.6	44.9	55 44.7	37.0	185 54.6	45.8	11 38.1	39.3
N 11	231 01.1	319 44.6	44.9	70 46.1	36.6	200 57.3	45.8	26 40.3	39.3
D 12	246 03.6	334 43.7	S24 45.0	85 47.5	N10 36.3	215 59.9	N10 45.7	41 42.5	S 7 39.4
A 13	261 06.0	349 42.7	45.0	100 48.9	35.9	231 02.6	45.6	56 44.7	39.5
Y 14	276 08.5	4 41.8	45.1	115 50.3	35.5	246 05.3	45.6	71 47.0	39.6
15	291 11.0	19 40.8	45.1	130 51.7	35.2	261 08.0	45.5	86 49.2	39.7
16	306 13.4	34 39.9	45.2	145 53.1	34.8	276 10.7	45.4	101 51.4	39.8
17	321 15.9	49 38.9	45.2	160 54.5	34.4	291 13.4	45.4	116 53.6	39.9
18	336 18.3	64 38.0	S24 45.3	175 55.9	N10 34.1	306 16.1	N10 45.3	131 55.8	S 7 40.0
19	351 20.8	79 37.0	45.3	190 57.3	33.7	321 18.8	45.2	146 58.1	40.1
20	6 23.3	94 36.1	45.4	205 58.7	33.3	336 21.4	45.1	162 00.3	40.1
21	21 25.7	109 35.1	45.4	221 00.0	32.9	351 24.1	45.1	177 02.5	40.2
22	36 28.2	124 34.2	45.5	236 01.4	32.6	6 26.8	45.0	192 04.7	40.3
23	51 30.7	139 33.2	45.5	251 02.8	32.2	21 29.5	44.9	207 06.9	40.4
28 00	66 33.1	154 32.3	S24 45.5	266 04.2	N10 31.8	36 32.2	N10 44.9	222 09.2	S 7 40.5
01	81 35.6	169 31.3	45.6	281 05.6	31.5	51 34.9	44.8	237 11.4	40.6
02	96 38.1	184 30.4	45.6	296 07.0	31.1	66 37.6	44.7	252 13.6	40.7
03	111 40.5	199 29.4	45.6	311 08.4	30.7	81 40.2	44.7	267 15.8	40.8
04	126 43.0	214 28.5	45.7	326 09.8	30.4	96 42.9	44.6	282 18.0	40.8
05	141 45.5	229 27.5	45.7	341 11.2	30.0	111 45.6	44.5	297 20.3	40.9
06	156 47.9	244 26.6	S24 45.7	356 12.6	N10 29.6	126 48.3	N10 44.5	312 22.5	S 7 41.0
07	171 50.4	259 25.6	45.8	11 14.0	29.3	141 51.0	44.4	327 24.7	41.1
08	186 52.8	274 24.7	45.8	26 15.4	28.9	156 53.7	44.3	342 26.9	41.2
M 09	201 55.3	289 23.7	45.8	41 16.8	28.5	171 56.3	44.3	357 29.1	41.3
O 10	216 57.8	304 22.8	45.9	56 18.2	28.2	186 59.0	44.2	12 31.4	41.4
N 11	232 00.2	319 21.8	45.9	71 19.6	27.8	202 01.7	44.1	27 33.6	41.4
D 12	247 02.7	334 20.9	S24 45.9	86 21.0	N10 27.4	217 04.4	N10 44.1	42 35.8	S 7 41.5
A 13	262 05.2	349 19.9	45.9	101 22.4	27.1	232 07.1	44.0	57 38.0	41.6
Y 14	277 07.6	4 18.9	45.9	116 23.8	26.7	247 09.8	43.9	72 40.2	41.7
15	292 10.1	19 18.0	46.0	131 25.2	26.3	262 12.4	43.9	87 42.5	41.8
16	307 12.6	34 17.0	46.0	146 26.6	26.0	277 15.1	43.8	102 44.7	41.9
17	322 15.0	49 16.1	46.0	161 28.0	25.6	292 17.8	43.7	117 46.9	42.0
18	337 17.5	64 15.1	S24 46.0	176 29.4	N10 25.2	307 20.5	N10 43.7	132 49.1	S 7 42.1
19	352 20.0	79 14.2	46.0	191 30.8	24.9	322 23.2	43.6	147 51.3	42.1
20	7 22.4	94 13.2	46.0	206 32.2	24.5	337 25.8	43.5	162 53.6	42.2
21	22 24.9	109 12.3	46.0	221 33.6	24.1	352 28.5	43.5	177 55.8	42.3
22	37 27.3	124 11.3	46.1	236 35.0	23.8	7 31.2	43.4	192 58.0	42.4
23	52 29.8	139 10.4	46.1	251 36.4	23.4	22 33.9	43.3	208 00.2	42.5
29 00	67 32.3	154 09.4	S24 46.1	266 37.8	N10 23.0	37 36.6	N10 43.3	223 02.5	S 7 42.6
01	82 34.7	169 08.5	46.1	281 39.3	22.7	52 39.2	43.2	238 04.7	42.7
02	97 37.2	184 07.5	46.1	296 40.7	22.3	67 41.9	43.1	253 06.9	42.8
03	112 39.7	199 06.6	46.1	311 42.1	21.9	82 44.6	43.1	268 09.1	42.8
04	127 42.1	214 05.6	46.1	326 43.5	21.6	97 47.3	43.0	283 11.3	42.9
05	142 44.6	229 04.7	46.1	341 44.9	21.2	112 49.9	42.9	298 13.6	43.0
06	157 47.1	244 03.7	S24 46.1	356 46.3	N10 20.8	127 52.6	N10 42.9	313 15.8	S 7 43.1
07	172 49.5	259 02.8	46.1	11 47.7	20.5	142 55.3	42.8	328 18.0	43.2
T 08	187 52.0	274 01.8	46.1	26 49.1	20.1	157 58.0	42.7	343 20.2	43.3
U 09	202 54.5	289 00.9	46.1	41 50.5	19.7	173 00.7	42.7	358 22.5	43.4
E 10	217 56.9	303 59.9	46.1	56 51.9	19.4	188 03.3	42.6	13 24.7	43.4
S 11	232 59.4	318 59.0	46.1	71 53.3	19.0	203 06.0	42.5	28 26.9	43.5
D 12	248 01.8	333 58.0	S24 46.1	86 54.8	N10 18.6	218 08.7	N10 42.5	43 29.1	S 7 43.6
A 13	263 04.3	348 57.1	46.1	101 56.2	18.3	233 11.4	42.4	58 31.3	43.7
Y 14	278 06.8	3 56.1	46.0	116 57.6	17.9	248 14.0	42.3	73 33.6	43.8
15	293 09.2	18 55.2	46.0	131 59.0	17.6	263 16.7	42.3	88 35.8	43.9
16	308 11.7	33 54.2	46.0	147 00.4	17.2	278 19.4	42.2	103 38.0	44.0
17	323 14.2	48 53.3	46.0	162 01.8	16.8	293 22.1	42.1	118 40.2	44.0
18	338 16.6	63 52.3	S24 46.0	177 03.2	N10 16.5	308 24.7	N10 42.1	133 42.5	S 7 44.1
19	353 19.1	78 51.4	46.0	192 04.6	16.1	323 27.4	42.0	148 44.7	44.2
20	8 21.6	93 50.4	46.0	207 06.1	15.7	338 30.1	42.0	163 46.9	44.3
21	23 24.0	108 49.5	45.9	222 07.5	15.4	353 32.7	41.9	178 49.1	44.4
22	38 26.5	123 48.5	45.9	237 08.9	15.0	8 35.4	41.8	193 51.4	44.5
23	53 28.9	138 47.6	45.9	252 10.3	14.6	23 38.1	41.8	208 53.6	44.6
	h m								
Mer. Pass.	19 30.6	v −1.0	d 0.0	v 1.4	d 0.4	v 2.7	d 0.1	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.7	S40 15.4
Achernar	335 27.1	S57 10.7
Acrux	173 10.9	S63 09.7
Adhara	255 13.1	S28 59.3
Aldebaran	290 50.3	N16 32.0
Alioth	166 22.0	N55 53.4
Alkaid	153 00.1	N49 15.0
Al Na'ir	27 45.1	S46 54.3
Alnilam	275 47.2	S 1 11.7
Alphard	217 57.1	S 8 42.6
Alphecca	126 12.3	N26 40.5
Alpheratz	357 44.5	N29 09.7
Altair	62 09.5	N 8 54.2
Ankaa	353 16.5	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.0	N19 07.2
Atria	107 31.4	S69 02.9
Avior	234 18.1	S59 32.7
Bellatrix	278 32.9	N 6 21.6
Betelgeuse	271 02.2	N 7 24.5
Canopus	263 56.1	S52 42.0
Capella	280 35.6	N46 00.5
Deneb	49 32.5	N45 19.8
Denebola	182 34.9	N14 30.2
Diphda	348 56.8	S17 55.2
Dubhe	193 53.1	N61 40.8
Elnath	278 13.6	N28 37.0
Eltanin	90 47.2	N51 29.4
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.1	S29 33.5
Gacrux	172 02.5	S57 10.6
Gienah	175 53.6	S17 36.4
Hadar	148 50.0	S60 25.7
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.0	N74 06.2
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.6	S69 45.8
Mirfak	308 41.4	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.3	S56 41.9
Pollux	243 28.8	N27 59.6
Procyon	245 00.6	N 5 11.6
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.6	N11 54.4
Rigel	281 12.8	S 8 11.3
Rigil Kent.	139 53.9	S60 52.9
Sabik	102 14.1	S15 44.3
Schedar	349 41.5	N56 36.5
Shaula	96 23.8	S37 06.7
Sirius	258 34.4	S16 44.0
Spica	158 32.7	S11 13.4
Suhail	222 53.1	S43 28.7
Vega	80 40.1	N38 47.9
Zuben'ubi	137 07.0	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	87 59.1	13 43
Mars	199 31.1	6 15
Jupiter	329 59.1	21 30
Saturn	155 36.0	9 10

SUNDAY

MONDAY

TUESDAY

2011 NOVEMBER 27, 28, 29 (SUN., MON., TUES.)

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
27 00	183 09.7	S21 00.9	157 33.0	4.7	S22 09.0	2.8	59.7
01	198 09.5	01.4	171 56.7	4.7	22 06.2	3.0	59.6
02	213 09.3	01.9	186 20.4	4.9	22 03.2	3.1	59.6
03	228 09.1	02.3	200 44.3	4.9	22 00.1	3.2	59.6
04	243 08.9	02.8	215 08.2	5.0	21 56.9	3.4	59.5
05	258 08.7	03.3	229 32.2	5.0	21 53.5	3.5	59.5
06	273 08.5	S21 03.7	243 56.2	5.2	S21 50.0	3.7	59.5
07	288 08.3	04.2	258 20.4	5.2	21 46.3	3.8	59.4
08	303 08.1	04.7	272 44.6	5.3	21 42.5	4.0	59.4
S 09	318 07.9	05.1	287 08.9	5.4	21 38.5	4.1	59.4
U 10	333 07.7	05.6	301 33.3	5.4	21 34.4	4.3	59.3
N 11	348 07.5	06.0	315 57.7	5.6	21 30.1	4.3	59.3
D 12	3 07.3	S21 06.5	330 22.3	5.6	S21 25.8	4.6	59.3
A 13	18 07.1	07.0	344 46.9	5.8	21 21.2	4.6	59.2
Y 14	33 06.9	07.4	359 11.7	5.8	21 16.6	4.8	59.2
15	48 06.7	07.9	13 36.5	5.9	21 11.8	4.9	59.1
16	63 06.5	08.3	28 01.4	6.0	21 06.9	5.1	59.1
17	78 06.3	08.8	42 26.4	6.1	21 01.8	5.2	59.1
18	93 06.1	S21 09.2	56 51.5	6.2	S20 56.6	5.3	59.0
19	108 05.8	09.7	71 16.7	6.3	20 51.3	5.4	59.0
20	123 05.6	10.1	85 42.0	6.3	20 45.9	5.6	59.0
21	138 05.4	10.6	100 07.3	6.5	20 40.3	5.6	58.9
22	153 05.2	11.0	114 32.8	6.6	20 34.7	5.8	58.9
23	168 05.0	11.5	128 58.4	6.6	20 28.9	6.0	58.8
28 00	183 04.8	S21 11.9	143 24.0	6.8	S20 22.9	6.0	58.8
01	198 04.6	12.4	157 49.8	6.9	20 16.9	6.2	58.8
02	213 04.4	12.8	172 15.7	6.9	20 10.7	6.3	58.7
03	228 04.2	13.3	186 41.6	7.1	20 04.4	6.4	58.7
04	243 04.0	13.7	201 07.7	7.1	19 58.0	6.5	58.7
05	258 03.8	14.2	215 33.8	7.3	19 51.5	6.6	58.6
06	273 03.6	S21 14.6	230 00.1	7.3	S19 44.9	6.8	58.6
07	288 03.3	15.1	244 26.4	7.5	19 38.1	6.8	58.5
08	303 03.1	15.5	258 52.9	7.6	19 31.3	7.0	58.5
M 09	318 02.9	16.0	273 19.5	7.6	19 24.3	7.1	58.5
O 10	333 02.7	16.4	287 46.1	7.8	19 17.2	7.1	58.4
N 11	348 02.5	16.8	302 12.9	7.9	19 10.1	7.3	58.4
D 12	3 02.3	S21 17.3	316 39.8	7.9	S19 02.8	7.4	58.3
A 13	18 02.1	17.7	331 06.7	8.1	18 55.4	7.5	58.3
Y 14	33 01.9	18.2	345 33.8	8.2	18 47.9	7.6	58.3
15	48 01.7	18.6	0 01.0	8.3	18 40.3	7.6	58.2
16	63 01.4	19.0	14 28.3	8.3	18 32.7	7.8	58.2
17	78 01.2	19.5	28 55.6	8.5	18 24.9	7.9	58.2
18	93 01.0	S21 19.9	43 23.1	8.6	S18 17.0	8.0	58.1
19	108 00.8	20.4	57 50.7	8.7	18 09.0	8.0	58.1
20	123 00.6	20.8	72 18.4	8.8	18 01.0	8.2	58.0
21	138 00.4	21.2	86 46.2	8.9	17 52.8	8.2	58.0
22	153 00.2	21.7	101 14.1	9.0	17 44.6	8.4	58.0
23	167 59.9	22.1	115 42.1	9.1	17 36.2	8.4	57.9
29 00	182 59.7	S21 22.5	130 10.2	9.2	S17 27.8	8.5	57.9
01	197 59.5	23.0	144 38.4	9.3	17 19.3	8.6	57.8
02	212 59.3	23.4	159 06.7	9.4	17 10.7	8.6	57.8
03	227 59.1	23.8	173 35.1	9.5	17 02.1	8.8	57.8
04	242 58.9	24.3	188 03.6	9.7	16 53.3	8.8	57.7
05	257 58.7	24.7	202 32.3	9.7	16 44.5	8.9	57.7
06	272 58.4	S21 25.1	217 01.0	9.8	S16 35.6	9.0	57.6
07	287 58.2	25.5	231 29.8	9.9	16 26.6	9.1	57.6
T 08	302 58.0	26.0	245 58.7	10.0	16 17.5	9.2	57.6
U 09	317 57.8	26.4	260 27.7	10.1	16 08.3	9.2	57.5
E 10	332 57.6	26.8	274 56.8	10.2	15 59.1	9.3	57.5
S 11	347 57.3	27.3	289 26.0	10.3	15 49.8	9.3	57.5
D 12	2 57.1	S21 27.7	303 55.3	10.4	S15 40.5	9.5	57.4
A 13	17 56.9	28.1	318 24.7	10.6	15 31.0	9.4	57.4
Y 14	32 56.7	28.5	332 54.3	10.6	15 21.6	9.6	57.3
15	47 56.5	28.9	347 23.9	10.7	15 12.0	9.6	57.3
16	62 56.2	29.4	1 53.6	10.8	15 02.4	9.7	57.3
17	77 56.0	29.8	16 23.4	10.8	14 52.7	9.8	57.2
18	92 55.8	S21 30.2	30 53.2	11.0	S14 42.9	9.8	57.2
19	107 55.6	30.6	45 23.2	11.1	14 33.1	9.9	57.1
20	122 55.4	31.0	59 53.3	11.2	14 23.2	9.9	57.1
21	137 55.1	31.5	74 23.5	11.2	14 13.3	10.0	57.1
22	152 54.9	31.9	88 53.7	11.4	14 03.3	10.1	57.0
23	167 54.7	32.3	103 24.1	11.4	S13 53.2	10.1	57.0
	SD 16.2	d 0.4	SD	16.1		15.9	15.6

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 27	Moonrise 28	Moonrise 29	Moonrise 30
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 41	09 34	▬	▬	▬	13 43	13 10
N 70	07 26	08 59	▬	▬	13 41	13 08	12 51
68	07 14	08 34	10 17	13 10	12 51	12 42	12 35
66	07 04	08 15	09 35	12 09	12 19	12 22	12 23
64	06 55	07 59	09 07	11 35	11 55	12 06	12 13
62	06 47	07 46	08 45	11 10	11 37	11 53	12 04
60	06 40	07 35	08 28	10 50	11 21	11 42	11 56
N 58	06 34	07 25	08 13	10 33	11 08	11 32	11 49
56	06 29	07 16	08 01	10 19	10 56	11 23	11 43
54	06 24	07 08	07 50	10 07	10 46	11 15	11 38
52	06 19	07 01	07 41	09 57	10 37	11 08	11 33
50	06 14	06 55	07 32	09 47	10 29	11 02	11 29
45	06 05	06 41	07 14	09 27	10 12	10 49	11 19
N 40	05 56	06 29	06 59	09 10	09 58	10 37	11 11
35	05 48	06 19	06 46	08 57	09 46	10 28	11 04
30	05 40	06 10	06 35	08 45	09 35	10 19	10 58
20	05 26	05 53	06 16	08 24	09 17	10 05	10 47
N 10	05 11	05 37	06 00	08 06	09 02	09 52	10 38
0	04 56	05 22	05 44	07 49	08 47	09 40	10 29
S 10	04 39	05 06	05 28	07 32	08 32	09 28	10 20
20	04 19	04 47	05 11	07 15	08 16	09 15	10 11
30	03 53	04 25	04 52	06 54	07 58	09 00	10 00
35	03 36	04 11	04 40	06 42	07 47	08 52	09 54
40	03 15	03 55	04 27	06 28	07 35	08 42	09 47
45	02 49	03 35	04 11	06 11	07 21	08 30	09 38
S 50	02 11	03 09	03 51	05 51	07 03	08 16	09 28
52	01 51	02 57	03 42	05 41	06 54	08 10	09 24
54	01 24	02 42	03 31	05 30	06 45	08 02	09 19
56	00 40	02 24	03 19	05 18	06 34	07 54	09 13
58	////	02 02	03 05	05 04	06 22	07 45	09 06
S 60	////	01 33	02 49	04 47	06 08	07 34	08 59

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 27	Moonset 28	Moonset 29	Moonset 30
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	14 01	15 53	▬	▬	18 20	20 33
N 70	▬	14 36	16 09	▬	16 32	18 54	20 50
68	13 18	15 01	16 21	15 05	17 21	19 18	21 04
66	14 00	15 20	16 31	16 04	17 52	19 37	21 15
64	14 29	15 36	16 40	16 38	18 15	19 52	21 24
62	14 50	15 49	16 48	17 03	18 33	20 04	21 32
60	15 07	16 01	16 55	17 23	18 48	20 15	21 38
N 58	15 22	16 10	17 01	17 39	19 01	20 24	21 44
56	15 34	16 19	17 07	17 52	19 12	20 32	21 49
54	15 45	16 27	17 12	18 04	19 21	20 39	21 54
52	15 55	16 34	17 16	18 15	19 30	20 45	21 58
50	16 03	16 40	17 21	18 24	19 37	20 51	22 02
45	16 21	16 54	17 31	18 44	19 54	21 03	22 10
N 40	16 36	17 06	17 40	18 59	20 07	21 13	22 17
35	16 49	17 17	17 48	19 13	20 18	21 22	22 23
30	17 00	17 26	17 55	19 24	20 28	21 29	22 28
20	17 19	17 43	18 10	19 44	20 45	21 42	22 37
N 10	17 36	17 58	18 24	20 01	20 59	21 54	22 44
0	17 52	18 14	18 40	20 17	21 13	22 04	22 51
S 10	18 07	18 30	18 57	20 33	21 26	22 14	22 58
20	18 24	18 49	19 17	20 50	21 41	22 26	23 06
30	18 44	19 11	19 44	21 09	21 57	22 38	23 14
35	18 56	19 25	20 00	21 21	22 06	22 45	23 19
40	19 09	19 41	20 21	21 34	22 17	22 53	23 25
45	19 25	20 01	20 48	21 49	22 30	23 03	23 31
S 50	19 45	20 27	21 26	22 07	22 45	23 14	23 39
52	19 55	20 40	21 47	22 16	22 52	23 20	23 42
54	20 05	20 55	22 15	22 26	23 00	23 25	23 46
56	20 18	21 13	23 01	22 37	23 08	23 32	23 50
58	20 32	21 36	////	22 49	23 18	23 39	23 55
S 60	20 48	22 06	////	23 04	23 30	23 47	24 00

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
27	12 39	12 30	11 48	14 03	01 34	02	7
28	12 20	12 10	11 48	15 00	02 32	03	14
29	11 59	11 49	11 48	15 52	03 27	04	22

UT	ARIES	VENUS −3.9		MARS +0.7		JUPITER −2.8		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
30 00	68 31.4	153 46.6	S24 45.9	267 11.7	N10 14.3	38 40.8	N10 41.7	223 55.8	S 7 44.6
01	83 33.9	168 45.7	45.8	282 13.1	13.9	53 43.4	41.6	238 58.0	44.7
02	98 36.3	183 44.7	45.8	297 14.6	13.6	68 46.1	41.6	254 00.3	44.8
03	113 38.8	198 43.8 . .	45.8	312 16.0 . .	13.2	83 48.8 . .	41.5	269 02.5 . .	44.9
04	128 41.3	213 42.8	45.8	327 17.4	12.8	98 51.5	41.4	284 04.7	45.0
05	143 43.7	228 41.9	45.7	342 18.8	12.5	113 54.1	41.4	299 06.9	45.1
06	158 46.2	243 40.9	S24 45.7	357 20.2	N10 12.1	128 56.8	N10 41.3	314 09.1	S 7 45.2
W 07	173 48.7	258 40.0	45.7	12 21.7	11.8	143 59.5	41.3	329 11.4	45.2
E 08	188 51.1	273 39.0	45.6	27 23.1	11.4	159 02.1	41.2	344 13.6	45.3
D 09	203 53.6	288 38.1 . .	45.6	42 24.5 . .	11.0	174 04.8 . .	41.1	359 15.8 . .	45.4
N 10	218 56.1	303 37.1	45.6	57 25.9	10.7	189 07.5	41.1	14 18.0	45.5
E 11	233 58.5	318 36.2	45.5	72 27.3	10.3	204 10.1	41.0	29 20.3	45.6
S 12	249 01.0	333 35.2	S24 45.5	87 28.8	N10 09.9	219 12.8	N10 40.9	44 22.5	S 7 45.7
D 13	264 03.4	348 34.3	45.4	102 30.2	09.6	234 15.5	40.9	59 24.7	45.7
A 14	279 05.9	3 33.3	45.4	117 31.6	09.2	249 18.1	40.8	74 26.9	45.8
Y 15	294 08.4	18 32.4 . .	45.3	132 33.0 . .	08.9	264 20.8 . .	40.8	89 29.2 . .	45.9
16	309 10.8	33 31.4	45.3	147 34.5	08.5	279 23.5	40.7	104 31.4	46.0
17	324 13.3	48 30.5	45.3	162 35.9	08.1	294 26.1	40.6	119 33.6	46.1
18	339 15.8	63 29.5	S24 45.2	177 37.3	N10 07.8	309 28.8	N10 40.6	134 35.8	S 7 46.2
19	354 18.2	78 28.6	45.2	192 38.7	07.4	324 31.5	40.5	149 38.1	46.3
20	9 20.7	93 27.6	45.1	207 40.2	07.1	339 34.2	40.5	164 40.3	46.3
21	24 23.2	108 26.7 . .	45.1	222 41.6 . .	06.7	354 36.8 . .	40.4	179 42.5 . .	46.4
22	39 25.6	123 25.7	45.0	237 43.0	06.4	9 39.5	40.3	194 44.8	46.5
23	54 28.1	138 24.8	45.0	252 44.4	06.0	24 42.1	40.3	209 47.0	46.6
1 00	69 30.6	153 23.8	S24 44.9	267 45.9	N10 05.6	39 44.8	N10 40.2	224 49.2	S 7 46.7
01	84 33.0	168 22.9	44.8	282 47.3	05.3	54 47.5	40.1	239 51.4	46.8
02	99 35.5	183 22.0	44.8	297 48.7	04.9	69 50.1	40.1	254 53.7	46.8
03	114 37.9	198 21.0 . .	44.7	312 50.1 . .	04.6	84 52.8 . .	40.0	269 55.9 . .	46.9
04	129 40.4	213 20.1	44.7	327 51.6	04.2	99 55.5	40.0	284 58.1	47.0
05	144 42.9	228 19.1	44.6	342 53.0	03.8	114 58.1	39.9	300 00.3	47.1
06	159 45.3	243 18.2	S24 44.5	357 54.4	N10 03.5	130 00.8	N10 39.8	315 02.6	S 7 47.2
07	174 47.8	258 17.2	44.5	12 55.9	03.1	145 03.5	39.8	330 04.8	47.3
T 08	189 50.3	273 16.3	44.4	27 57.3	02.8	160 06.1	39.7	345 07.0	47.4
H 09	204 52.7	288 15.3 . .	44.3	42 58.7 . .	02.4	175 08.8 . .	39.7	0 09.2 . .	47.4
U 10	219 55.2	303 14.4	44.3	58 00.2	02.1	190 11.5	39.6	15 11.5	47.5
R 11	234 57.7	318 13.4	44.2	73 01.6	01.7	205 14.1	39.5	30 13.7	47.6
S 12	250 00.1	333 12.5	S24 44.1	88 03.0	N10 01.3	220 16.8	N10 39.5	45 15.9	S 7 47.7
D 13	265 02.6	348 11.5	44.1	103 04.5	01.0	235 19.4	39.4	60 18.1	47.8
A 14	280 05.0	3 10.6	44.0	118 05.9	00.6	250 22.1	39.4	75 20.4	47.9
Y 15	295 07.5	18 09.6 . .	43.9	133 07.3	10 00.3	265 24.8 . .	39.3	90 22.6 . .	47.9
16	310 10.0	33 08.7	43.8	148 08.8	9 59.9	280 27.4	39.2	105 24.8	48.0
17	325 12.4	48 07.7	43.8	163 10.2	59.6	295 30.1	39.2	120 27.1	48.1
18	340 14.9	63 06.8	S24 43.7	178 11.6	N 9 59.2	310 32.7	N10 39.1	135 29.3	S 7 48.2
19	355 17.4	78 05.8	43.6	193 13.1	58.8	325 35.4	39.1	150 31.5	48.3
20	10 19.8	93 04.9	43.5	208 14.5	58.5	340 38.1	39.0	165 33.7	48.4
21	25 22.3	108 04.0 . .	43.4	223 15.9 . .	58.1	355 40.7 . .	38.9	180 36.0 . .	48.4
22	40 24.8	123 03.0	43.4	238 17.4	57.8	10 43.4	38.9	195 38.2	48.5
23	55 27.2	138 02.1	43.3	253 18.8	57.4	25 46.0	38.8	210 40.4	48.6
2 00	70 29.7	153 01.1	S24 43.2	268 20.3	N 9 57.1	40 48.7	N10 38.8	225 42.7	S 7 48.7
01	85 32.2	168 00.2	43.1	283 21.7	56.7	55 51.4	38.7	240 44.9	48.8
02	100 34.6	182 59.2	43.0	298 23.1	56.4	70 54.0	38.7	255 47.1	48.9
03	115 37.1	197 58.3 . .	42.9	313 24.6 . .	56.0	85 56.7 . .	38.6	270 49.3 . .	48.9
04	130 39.5	212 57.3	42.8	328 26.0	55.6	100 59.3	38.5	285 51.6	49.0
05	145 42.0	227 56.4	42.7	343 27.5	55.3	116 02.0	38.5	300 53.8	49.1
06	160 44.5	242 55.4	S24 42.6	358 28.9	N 9 54.9	131 04.6	N10 38.4	315 56.0	S 7 49.2
07	175 46.9	257 54.5	42.5	13 30.3	54.6	146 07.3	38.4	330 58.3	49.3
08	190 49.4	272 53.6	42.4	28 31.8	54.2	161 09.9	38.3	346 00.5	49.4
F 09	205 51.9	287 52.6 . .	42.3	43 33.2 . .	53.9	176 12.6 . .	38.3	1 02.7 . .	49.4
R 10	220 54.3	302 51.7	42.2	58 34.7	53.5	191 15.3	38.2	16 04.9	49.5
I 11	235 56.8	317 50.7	42.1	73 36.1	53.2	206 17.9	38.1	31 07.2	49.6
D 12	250 59.3	332 49.8	S24 42.0	88 37.6	N 9 52.8	221 20.6	N10 38.1	46 09.4	S 7 49.7
A 13	266 01.7	347 48.8	41.9	103 39.0	52.5	236 23.2	38.0	61 11.6	49.8
Y 14	281 04.2	2 47.9	41.8	118 40.4	52.1	251 25.9	38.0	76 13.9	49.9
15	296 06.7	17 46.9 . .	41.7	133 41.9 . .	51.8	266 28.5 . .	37.9	91 16.1 . .	49.9
16	311 09.1	32 46.0	41.6	148 43.3	51.4	281 31.2	37.9	106 18.3	50.0
17	326 11.6	47 45.1	41.5	163 44.8	51.0	296 33.8	37.8	121 20.5	50.1
18	341 14.0	62 44.1	S24 41.4	178 46.2	N 9 50.7	311 36.5	N10 37.7	136 22.8	S 7 50.2
19	356 16.5	77 43.2	41.3	193 47.7	50.3	326 39.1	37.7	151 25.0	50.3
20	11 19.0	92 42.2	41.2	208 49.1	50.0	341 41.8	37.6	166 27.2	50.4
21	26 21.4	107 41.3 . .	41.1	223 50.6 . .	49.6	356 44.4 . .	37.6	181 29.5 . .	50.4
22	41 23.9	122 40.3	40.9	238 52.0	49.3	11 47.1	37.5	196 31.7	50.5
23	56 26.4	137 39.4	40.8	253 53.5	48.9	26 49.8	37.5	211 33.9	50.6
	h m								
Mer. Pass.	19 18.8	v −0.9	d 0.1	v 1.4	d 0.4	v 2.7	d 0.1	v 2.2	d 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 18.7	S40 15.5
Achernar	335 27.1	S57 10.7
Acrux	173 10.9	S63 09.7
Adhara	255 13.1	S28 59.3
Aldebaran	290 50.3	N16 32.0
Alioth	166 21.9	N55 53.4
Alkaid	153 00.1	N49 15.0
Al Na'ir	27 45.1	S46 54.3
Alnilam	275 47.1	S 1 11.7
Alphard	217 57.1	S 8 42.7
Alphecca	126 12.3	N26 40.5
Alpheratz	357 44.5	N29 09.7
Altair	62 09.5	N 8 54.2
Ankaa	353 16.5	S42 14.5
Antares	112 28.0	S26 27.4
Arcturus	145 57.0	N19 07.2
Atria	107 31.4	S69 02.9
Avior	234 18.1	S59 32.7
Bellatrix	278 32.8	N 6 21.6
Betelgeuse	271 02.2	N 7 24.5
Canopus	263 56.1	S52 42.1
Capella	280 35.6	N46 00.5
Deneb	49 32.5	N45 19.7
Denebola	182 34.9	N14 30.2
Diphda	348 56.8	S17 55.2
Dubhe	193 53.0	N61 40.8
Elnath	278 13.6	N28 37.0
Eltanin	90 47.2	N51 29.4
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.1	S29 33.5
Gacrux	172 02.4	S57 10.6
Gienah	175 53.6	S17 36.4
Hadar	148 50.0	S60 25.6
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.0	N74 06.2
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.3
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.6	S69 45.8
Mirfak	308 41.4	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.3	S56 41.9
Pollux	243 28.8	N27 59.6
Procyon	245 00.6	N 5 11.6
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.6	N11 54.4
Rigel	281 12.8	S 8 11.3
Rigil Kent.	139 53.8	S60 52.9
Sabik	102 14.1	S15 44.3
Schedar	349 41.5	N56 36.5
Shaula	96 23.8	S37 06.7
Sirius	258 34.4	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.1	S43 28.7
Vega	80 40.1	N38 47.9
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	83 53.3	13 47
Mars	198 15.3	6 08
Jupiter	330 14.3	21 17
Saturn	155 18.7	8 59

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
30 00	182 54.5	S21 32.7	117 54.5	11.6	S13 43.1	10.2	57.0
01	197 54.3	33.1	132 25.1	11.6	13 32.9	10.2	56.9
02	212 54.0	33.5	146 55.7	11.7	13 22.7	10.3	56.9
03	227 53.8	. . 34.0	161 26.4	11.8	13 12.4	10.3	56.8
04	242 53.6	34.4	175 57.2	11.9	13 02.1	10.4	56.8
05	257 53.4	34.8	190 28.1	12.0	12 51.7	10.4	56.8
06	272 53.1	S21 35.2	204 59.1	12.0	S12 41.3	10.4	56.7
W 07	287 52.9	35.6	219 30.1	12.2	12 30.9	10.6	56.7
E 08	302 52.7	36.0	234 01.3	12.2	12 20.3	10.5	56.7
D 09	317 52.5	. . 36.4	248 32.5	12.3	12 09.8	10.6	56.6
N 10	332 52.2	36.8	263 03.8	12.4	11 59.2	10.7	56.6
E 11	347 52.0	37.2	277 35.2	12.5	11 48.5	10.7	56.6
S 12	2 51.8	S21 37.7	292 06.7	12.5	S11 37.8	10.7	56.5
D 13	17 51.6	38.1	306 38.2	12.7	11 27.1	10.8	56.5
A 14	32 51.3	38.5	321 09.9	12.7	11 16.3	10.8	56.4
Y 15	47 51.1	. . 38.9	335 41.6	12.8	11 05.5	10.8	56.4
16	62 50.9	39.3	350 13.4	12.9	10 54.7	10.9	56.4
17	77 50.7	39.7	4 45.3	12.9	10 43.8	10.9	56.3
18	92 50.4	S21 40.1	19 17.2	13.0	S10 32.9	11.0	56.3
19	107 50.2	40.5	33 49.2	13.1	10 21.9	11.0	56.3
20	122 50.0	40.9	48 21.3	13.2	10 10.9	11.0	56.2
21	137 49.7	. . 41.3	62 53.5	13.2	9 59.9	11.0	56.2
22	152 49.5	41.7	77 25.7	13.3	9 48.9	11.1	56.2
23	167 49.3	42.1	91 58.0	13.4	9 37.8	11.1	56.1
1 00	182 49.1	S21 42.5	106 30.4	13.4	S 9 26.7	11.2	56.1
01	197 48.8	42.9	121 02.8	13.6	9 15.5	11.2	56.1
02	212 48.6	43.3	135 35.4	13.5	9 04.3	11.2	56.0
03	227 48.4	. . 43.7	150 07.9	13.7	8 53.1	11.2	56.0
04	242 48.1	44.1	164 40.6	13.7	8 41.9	11.2	56.0
05	257 47.9	44.5	179 13.3	13.8	8 30.7	11.3	55.9
06	272 47.7	S21 44.9	193 46.1	13.8	S 8 19.4	11.3	55.9
T 07	287 47.5	45.3	208 18.9	13.9	8 08.1	11.3	55.9
H 08	302 47.2	45.7	222 51.8	14.0	7 56.8	11.4	55.8
U 09	317 47.0	. . 46.1	237 24.8	14.0	7 45.4	11.3	55.8
R 10	332 46.8	46.4	251 57.8	14.1	7 34.1	11.4	55.8
S 11	347 46.5	46.8	266 30.9	14.2	7 22.7	11.4	55.8
D 12	2 46.3	S21 47.2	281 04.1	14.2	S 7 11.3	11.4	55.7
A 13	17 46.1	47.6	295 37.3	14.2	6 59.9	11.5	55.7
Y 14	32 45.8	48.0	310 10.5	14.3	6 48.4	11.4	55.7
15	47 45.6	. . 48.4	324 43.8	14.4	6 37.0	11.5	55.6
16	62 45.4	48.8	339 17.2	14.4	6 25.5	11.5	55.6
17	77 45.1	49.2	353 50.6	14.5	6 14.0	11.5	55.6
18	92 44.9	S21 49.6	8 24.1	14.5	S 6 02.5	11.5	55.5
19	107 44.7	49.9	22 57.6	14.6	5 51.0	11.5	55.5
20	122 44.4	50.3	37 31.2	14.6	5 39.5	11.5	55.5
21	137 44.2	. . 50.7	52 04.8	14.7	5 28.0	11.6	55.5
22	152 44.0	51.1	66 38.5	14.7	5 16.4	11.5	55.4
23	167 43.7	51.5	81 12.2	14.8	5 04.9	11.6	55.4
2 00	182 43.5	S21 51.9	95 46.0	14.8	S 4 53.3	11.6	55.4
01	197 43.3	52.2	110 19.8	14.8	4 41.7	11.6	55.4
02	212 43.0	52.6	124 53.6	14.9	4 30.1	11.5	55.3
03	227 42.8	. . 53.0	139 27.5	14.9	4 18.6	11.6	55.3
04	242 42.5	53.4	154 01.4	15.0	4 07.0	11.6	55.3
05	257 42.3	53.8	168 35.4	15.0	3 55.4	11.7	55.2
06	272 42.1	S21 54.1	183 09.4	15.1	S 3 43.7	11.6	55.2
07	287 41.8	54.5	197 43.5	15.1	3 32.1	11.6	55.2
08	302 41.6	54.9	212 17.6	15.1	3 20.5	11.6	55.2
F 09	317 41.4	. . 55.3	226 51.7	15.2	3 08.9	11.6	55.1
R 10	332 41.1	55.6	241 25.9	15.2	2 57.3	11.7	55.1
I 11	347 40.9	56.0	256 00.1	15.2	2 45.6	11.6	55.1
D 12	2 40.6	S21 56.4	270 34.3	15.3	S 2 34.0	11.6	55.1
A 13	17 40.4	56.8	285 08.6	15.3	2 22.4	11.6	55.1
Y 14	32 40.2	57.1	299 42.9	15.3	2 10.8	11.7	55.0
15	47 39.9	. . 57.5	314 17.2	15.4	1 59.1	11.6	55.0
16	62 39.7	57.9	328 51.6	15.4	1 47.5	11.6	55.0
17	77 39.4	58.2	343 26.0	15.4	1 35.9	11.6	55.0
18	92 39.2	S21 58.6	358 00.4	15.5	S 1 24.3	11.6	54.9
19	107 39.0	59.0	12 34.9	15.4	1 12.7	11.6	54.9
20	122 38.7	59.3	27 09.3	15.5	1 01.1	11.6	54.9
21	137 38.5	21 59.7	41 43.8	15.5	0 49.5	11.6	54.9
22	152 38.2	22 00.1	56 18.3	15.6	0 37.9	11.6	54.9
23	167 38.0	S22 00.4	70 52.9	15.6	S 0 26.3	11.6	54.8
	SD 16.2	d 0.4	SD 15.4		15.2		15.0

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 30	Moonrise 1	Moonrise 2	Moonrise 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	07 50	09 48	▬	13 10	12 48	12 30	12 14
N 70	07 34	09 10	▬	12 51	12 38	12 27	12 17
68	07 21	08 43	10 34	12 35	12 30	12 24	12 19
66	07 10	08 22	09 46	12 23	12 23	12 22	12 21
64	07 00	08 06	09 15	12 13	12 17	12 20	12 22
62	06 52	07 52	08 52	12 04	12 12	12 18	12 24
60	06 45	07 40	08 34	11 56	12 07	12 16	12 25
N 58	06 39	07 30	08 19	11 49	12 03	12 15	12 26
56	06 33	07 21	08 06	11 43	12 00	12 14	12 27
54	06 28	07 13	07 55	11 38	11 56	12 13	12 28
52	06 23	07 05	07 45	11 33	11 54	12 12	12 29
50	06 18	06 59	07 36	11 29	11 51	12 11	12 30
45	06 08	06 44	07 17	11 19	11 45	12 09	12 31
N 40	05 59	06 32	07 02	11 11	11 40	12 07	12 33
35	05 50	06 21	06 49	11 04	11 36	12 06	12 34
30	05 42	06 12	06 38	10 58	11 32	12 04	12 35
20	05 27	05 55	06 18	10 47	11 26	12 02	12 37
N 10	05 13	05 39	06 01	10 38	11 20	12 00	12 38
0	04 57	05 23	05 45	10 29	11 15	11 58	12 40
S 10	04 40	05 06	05 29	10 20	11 09	11 56	12 42
20	04 19	04 47	05 12	10 11	11 04	11 54	12 43
30	03 52	04 24	04 51	10 00	10 57	11 52	12 45
35	03 35	04 10	04 39	09 54	10 53	11 51	12 46
40	03 14	03 54	04 26	09 47	10 49	11 49	12 48
45	02 46	03 33	04 09	09 38	10 44	11 47	12 49
S 50	02 07	03 07	03 49	09 28	10 38	11 45	12 51
52	01 45	02 53	03 39	09 24	10 35	11 45	12 52
54	01 16	02 38	03 28	09 19	10 32	11 43	12 53
56	00 20	02 19	03 16	09 13	10 29	11 42	12 54
58	////	01 56	03 01	09 06	10 25	11 41	12 55
S 60	////	01 24	02 44	08 59	10 21	11 40	12 56

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 30	Moonset 1	Moonset 2	Moonset 3
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 49	15 47	20 33	22 28	24 15	00 15
N 70	▬	14 28	16 03	20 50	22 36	24 15	00 15
68	13 03	14 55	16 16	21 04	22 42	24 16	00 16
66	13 52	15 15	16 27	21 15	22 47	24 16	00 16
64	14 22	15 32	16 37	21 24	22 52	24 16	00 16
62	14 45	15 46	16 45	21 32	22 56	24 16	00 16
60	15 03	15 57	16 52	21 38	22 59	24 17	00 17
N 58	15 18	16 08	16 59	21 44	23 02	24 17	00 17
56	15 31	16 17	17 04	21 49	23 04	24 17	00 17
54	15 43	16 25	17 10	21 54	23 07	24 17	00 17
52	15 52	16 32	17 15	21 58	23 09	24 17	00 17
50	16 01	16 39	17 19	22 02	23 11	24 17	00 17
45	16 20	16 53	17 30	22 10	23 15	24 17	00 17
N 40	16 35	17 05	17 39	22 17	23 18	24 18	00 18
35	16 48	17 16	17 47	22 23	23 21	24 18	00 18
30	17 00	17 26	17 55	22 28	23 24	24 18	00 18
20	17 19	17 43	18 10	22 37	23 28	24 18	00 18
N 10	17 36	17 59	18 25	22 44	23 32	24 18	00 18
0	17 53	18 15	18 41	22 51	23 36	24 18	00 18
S 10	18 09	18 32	18 58	22 58	23 39	24 18	00 18
20	18 26	18 51	19 19	23 06	23 43	24 19	00 19
30	18 47	19 14	19 46	23 14	23 48	24 19	00 19
35	18 59	19 28	20 04	23 19	23 50	24 19	00 19
40	19 13	19 45	20 25	23 25	23 53	24 19	00 19
45	19 29	20 05	20 52	23 31	23 56	24 19	00 19
S 50	19 50	20 32	21 32	23 39	24 00	00 00	00 19
52	19 59	20 45	21 54	23 42	24 01	00 01	00 19
54	20 10	21 01	22 25	23 46	24 03	00 03	00 19
56	20 23	21 20	23 27	23 50	24 05	00 05	00 19
58	20 38	21 44	////	23 55	24 08	00 08	00 19
S 60	20 55	22 17	////	24 00	00 00	00 10	00 19

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
30	11 38	11 28	11 49	16 40	04 17	05	31
1	11 17	11 06	11 49	17 25	05 03	06	41
2	10 54	10 43	11 49	18 08	05 47	07	51

UT	ARIES	VENUS −3.9		MARS +0.7		JUPITER −2.8		SATURN +0.8	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
3 00	71 28.8	152 38.4	S24 40.7	268 54.9	N 9 48.6	41 52.4	N10 37.4	226 36.2	S 7 50.7
01	86 31.3	167 37.5	40.6	283 56.4	48.2	56 55.1	37.3	241 38.4	50.8
02	101 33.8	182 36.6	40.5	298 57.8	47.9	71 57.7	37.3	256 40.6	50.8
03	116 36.2	197 35.6	40.3	313 59.3	47.5	87 00.4	37.2	271 42.8	50.9
04	131 38.7	212 34.7	40.2	329 00.7	47.2	102 03.0	37.2	286 45.1	51.0
05	146 41.1	227 33.7	40.1	344 02.2	46.8	117 05.7	37.1	301 47.3	51.1
06	161 43.6	242 32.8	S24 40.0	359 03.6	N 9 46.5	132 08.3	N10 37.1	316 49.5	S 7 51.2
07	176 46.1	257 31.9	39.8	14 05.1	46.1	147 11.0	37.0	331 51.8	51.3
S 08	191 48.5	272 30.9	39.7	29 06.5	45.8	162 13.6	37.0	346 54.0	51.3
A 09	206 51.0	287 30.0	39.6	44 08.0	45.4	177 16.2	36.9	1 56.2	51.4
T 10	221 53.5	302 29.0	39.5	59 09.4	45.1	192 18.9	36.9	16 58.5	51.5
U 11	236 55.9	317 28.1	39.3	74 10.9	44.7	207 21.5	36.8	32 00.7	51.6
R 12	251 58.4	332 27.1	S24 39.2	89 12.4	N 9 44.4	222 24.2	N10 36.7	47 02.9	S 7 51.7
D 13	267 00.9	347 26.2	39.1	104 13.8	44.0	237 26.8	36.7	62 05.2	51.8
A 14	282 03.3	2 25.3	38.9	119 15.3	43.7	252 29.5	36.6	77 07.4	51.8
Y 15	297 05.8	17 24.3	38.8	134 16.7	43.3	267 32.1	36.6	92 09.6	51.9
16	312 08.3	32 23.4	38.6	149 18.2	43.0	282 34.8	36.5	107 11.8	52.0
17	327 10.7	47 22.4	38.5	164 19.6	42.6	297 37.4	36.5	122 14.1	52.1
18	342 13.2	62 21.5	S24 38.4	179 21.1	N 9 42.3	312 40.1	N10 36.4	137 16.3	S 7 52.2
19	357 15.6	77 20.6	38.2	194 22.6	41.9	327 42.7	36.4	152 18.5	52.2
20	12 18.1	92 19.6	38.1	209 24.0	41.6	342 45.4	36.3	167 20.8	52.3
21	27 20.6	107 18.7	37.9	224 25.5	41.2	357 48.0	36.3	182 23.0	52.4
22	42 23.0	122 17.7	37.8	239 26.9	40.9	12 50.7	36.2	197 25.2	52.5
23	57 25.5	137 16.8	37.6	254 28.4	40.5	27 53.3	36.2	212 27.5	52.6
4 00	72 28.0	152 15.9	S24 37.5	269 29.9	N 9 40.2	42 55.9	N10 36.1	227 29.7	S 7 52.6
01	87 30.4	167 14.9	37.3	284 31.3	39.8	57 58.6	36.0	242 31.9	52.7
02	102 32.9	182 14.0	37.2	299 32.8	39.5	73 01.2	36.0	257 34.2	52.8
03	117 35.4	197 13.0	37.0	314 34.2	39.1	88 03.9	35.9	272 36.4	52.9
04	132 37.8	212 12.1	36.9	329 35.7	38.8	103 06.5	35.9	287 38.6	53.0
05	147 40.3	227 11.2	36.7	344 37.2	38.5	118 09.2	35.8	302 40.9	53.1
06	162 42.8	242 10.2	S24 36.6	359 38.6	N 9 38.1	133 11.8	N10 35.8	317 43.1	S 7 53.1
07	177 45.2	257 09.3	36.4	14 40.1	37.8	148 14.4	35.7	332 45.3	53.2
08	192 47.7	272 08.4	36.2	29 41.6	37.4	163 17.1	35.7	347 47.6	53.3
S 09	207 50.1	287 07.4	36.1	44 43.0	37.1	178 19.7	35.6	2 49.8	53.4
U 10	222 52.6	302 06.5	35.9	59 44.5	36.7	193 22.4	35.6	17 52.0	53.5
N 11	237 55.1	317 05.5	35.8	74 46.0	36.4	208 25.0	35.5	32 54.3	53.5
D 12	252 57.5	332 04.6	S24 35.6	89 47.4	N 9 36.0	223 27.6	N10 35.5	47 56.5	S 7 53.6
A 13	268 00.0	347 03.7	35.4	104 48.9	35.7	238 30.3	35.4	62 58.7	53.7
Y 14	283 02.5	2 02.7	35.3	119 50.4	35.3	253 32.9	35.4	78 01.0	53.8
15	298 04.9	17 01.8	35.1	134 51.8	35.0	268 35.6	35.3	93 03.2	53.9
16	313 07.4	32 00.9	34.9	149 53.3	34.7	283 38.2	35.3	108 05.4	53.9
17	328 09.9	46 59.9	34.8	164 54.8	34.3	298 40.8	35.2	123 07.7	54.0
18	343 12.3	61 59.0	S24 34.6	179 56.2	N 9 34.0	313 43.5	N10 35.2	138 09.9	S 7 54.1
19	358 14.8	76 58.1	34.4	194 57.7	33.6	328 46.1	35.1	153 12.1	54.2
20	13 17.2	91 57.1	34.2	209 59.2	33.3	343 48.8	35.1	168 14.4	54.3
21	28 19.7	106 56.2	34.1	225 00.6	32.9	358 51.4	35.0	183 16.6	54.3
22	43 22.2	121 55.2	33.9	240 02.1	32.6	13 54.0	35.0	198 18.8	54.4
23	58 24.6	136 54.3	33.7	255 03.6	32.2	28 56.7	34.9	213 21.1	54.5
5 00	73 27.1	151 53.4	S24 33.5	270 05.1	N 9 31.9	43 59.3	N10 34.9	228 23.3	S 7 54.6
01	88 29.6	166 52.4	33.3	285 06.5	31.6	59 01.9	34.8	243 25.5	54.7
02	103 32.0	181 51.5	33.2	300 08.0	31.2	74 04.6	34.8	258 27.8	54.7
03	118 34.5	196 50.6	33.0	315 09.5	30.9	89 07.2	34.7	273 30.0	54.8
04	133 37.0	211 49.6	32.8	330 11.0	30.5	104 09.8	34.7	288 32.3	54.9
05	148 39.4	226 48.7	32.6	345 12.4	30.2	119 12.5	34.6	303 34.5	55.0
06	163 41.9	241 47.8	S24 32.4	0 13.9	N 9 29.8	134 15.1	N10 34.6	318 36.7	S 7 55.1
07	178 44.4	256 46.8	32.2	15 15.4	29.5	149 17.7	34.5	333 39.0	55.1
08	193 46.8	271 45.9	32.0	30 16.9	29.2	164 20.4	34.5	348 41.2	55.2
M 09	208 49.3	286 45.0	31.8	45 18.3	28.8	179 23.0	34.4	3 43.4	55.3
O 10	223 51.7	301 44.0	31.6	60 19.8	28.5	194 25.7	34.4	18 45.7	55.4
N 11	238 54.2	316 43.1	31.5	75 21.3	28.1	209 28.3	34.3	33 47.9	55.5
D 12	253 56.7	331 42.2	S24 31.3	90 22.8	N 9 27.8	224 30.9	N10 34.3	48 50.1	S 7 55.5
A 13	268 59.1	346 41.2	31.1	105 24.3	27.4	239 33.5	34.2	63 52.4	55.6
Y 14	284 01.6	1 40.3	30.9	120 25.7	27.1	254 36.2	34.2	78 54.6	55.7
15	299 04.1	16 39.4	30.7	135 27.2	26.8	269 38.8	34.1	93 56.8	55.8
16	314 06.5	31 38.5	30.5	150 28.7	26.4	284 41.4	34.1	108 59.1	55.9
17	329 09.0	46 37.5	30.3	165 30.2	26.1	299 44.1	34.0	124 01.3	55.9
18	344 11.5	61 36.6	S24 30.1	180 31.7	N 9 25.7	314 46.7	N10 34.0	139 03.6	S 7 56.0
19	359 13.9	76 35.7	29.9	195 33.1	25.4	329 49.3	33.9	154 05.8	56.1
20	14 16.4	91 34.7	29.6	210 34.6	25.1	344 52.0	33.9	169 08.0	56.2
21	29 18.9	106 33.8	29.4	225 36.1	24.7	359 54.6	33.8	184 10.3	56.3
22	44 21.3	121 32.9	29.2	240 37.6	24.4	14 57.2	33.8	199 12.5	56.3
23	59 23.8	136 31.9	29.0	255 39.1	24.0	29 59.9	33.7	214 14.7	56.4
	h m								
Mer. Pass.	19 07.0	*v* −0.9	*d* 0.2	*v* 1.5	*d* 0.3	*v* 2.6	*d* 0.1	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.5
Achernar	335 27.1	S57 10.7
Acrux	173 10.8	S63 09.7
Adhara	255 13.1	S28 59.3
Aldebaran	290 50.3	N16 32.0
Alioth	166 21.9	N55 53.4
Alkaid	153 00.1	N49 15.0
Al Na'ir	27 45.2	S46 54.3
Alnilam	275 47.1	S 1 11.7
Alphard	217 57.0	S 8 42.7
Alphecca	126 12.3	N26 40.5
Alpheratz	357 44.5	N29 09.7
Altair	62 09.5	N 8 54.2
Ankaa	353 16.6	S42 14.6
Antares	112 28.0	S26 27.4
Arcturus	145 57.0	N19 07.2
Atria	107 31.4	S69 02.8
Avior	234 18.1	S59 32.7
Bellatrix	278 32.8	N 6 21.6
Betelgeuse	271 02.1	N 7 24.5
Canopus	263 56.1	S52 42.1
Capella	280 35.6	N46 00.5
Deneb	49 32.5	N45 19.7
Denebola	182 34.8	N14 30.2
Diphda	348 56.8	S17 55.2
Dubhe	193 53.0	N61 40.8
Elnath	278 13.6	N28 37.0
Eltanin	90 47.2	N51 29.4
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.2	S29 33.6
Gacrux	172 02.4	S57 10.6
Gienah	175 53.6	S17 36.4
Hadar	148 50.0	S60 25.6
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 21.0	N74 06.2
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.2
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.5	S69 45.8
Mirfak	308 41.4	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.3	S56 41.9
Pollux	243 28.8	N27 59.6
Procyon	245 00.6	N 5 11.6
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.6	N11 54.4
Rigel	281 12.8	S 8 11.3
Rigil Kent.	139 53.8	S60 52.9
Sabik	102 14.1	S15 44.3
Schedar	349 41.5	N56 36.5
Shaula	96 23.8	S37 06.7
Sirius	258 34.4	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.1	S43 28.7
Vega	80 40.1	N38 47.9
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	79 47.9	13 52
Mars	197 01.9	6 01
Jupiter	330 28.0	21 05
Saturn	155 01.7	8 49

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
3 00	182 37.8	S22 00.8	85 27.5	15.5	S 0 14.7	11.6	54.8
01	197 37.5	01.2	100 02.0	15.6	S 0 03.1	11.6	54.8
02	212 37.3	01.5	114 36.6	15.7	N 0 08.5	11.5	54.8
03	227 37.0	01.9	129 11.3	15.6	0 20.0	11.6	54.8
04	242 36.8	02.2	143 45.9	15.7	0 31.6	11.5	54.7
05	257 36.5	02.6	158 20.6	15.7	0 43.1	11.6	54.7
06	272 36.3	S22 03.0	172 55.3	15.6	N 0 54.7	11.5	54.7
07	287 36.1	03.3	187 29.9	15.8	1 06.2	11.5	54.7
S 08	302 35.8	03.7	202 04.7	15.7	1 17.7	11.5	54.7
A 09	317 35.6	04.0	216 39.4	15.7	1 29.2	11.5	54.6
T 10	332 35.3	04.4	231 14.1	15.7	1 40.7	11.4	54.6
U 11	347 35.1	04.8	245 48.8	15.8	1 52.1	11.5	54.6
R 12	2 34.8	S22 05.1	260 23.6	15.8	N 2 03.6	11.4	54.6
D 13	17 34.6	05.5	274 58.4	15.7	2 15.0	11.5	54.6
A 14	32 34.3	05.8	289 33.1	15.8	2 26.5	11.4	54.6
Y 15	47 34.1	06.2	304 07.9	15.8	2 37.9	11.4	54.5
16	62 33.9	06.5	318 42.7	15.8	2 49.3	11.3	54.5
17	77 33.6	06.9	333 17.5	15.8	3 00.6	11.4	54.5
18	92 33.4	S22 07.2	347 52.3	15.8	N 3 12.0	11.3	54.5
19	107 33.1	07.6	2 27.1	15.8	3 23.3	11.4	54.5
20	122 32.9	07.9	17 01.9	15.8	3 34.7	11.3	54.5
21	137 32.6	08.3	31 36.7	15.8	3 46.0	11.2	54.4
22	152 32.4	08.6	46 11.5	15.8	3 57.2	11.3	54.4
23	167 32.1	09.0	60 46.3	15.8	4 08.5	11.3	54.4
4 00	182 31.9	S22 09.3	75 21.1	15.8	N 4 19.8	11.2	54.4
01	197 31.6	09.7	89 55.9	15.8	4 31.0	11.2	54.4
02	212 31.4	10.0	104 30.7	15.8	4 42.2	11.1	54.4
03	227 31.1	10.3	119 05.5	15.8	4 53.3	11.2	54.4
04	242 30.9	10.7	133 40.3	15.8	5 04.5	11.1	54.4
05	257 30.6	11.0	148 15.1	15.8	5 15.6	11.1	54.3
06	272 30.4	S22 11.4	162 49.9	15.7	N 5 26.7	11.1	54.3
07	287 30.1	11.7	177 24.6	15.8	5 37.8	11.1	54.3
08	302 29.9	12.1	191 59.4	15.8	5 48.9	11.0	54.3
S 09	317 29.6	12.4	206 34.2	15.7	5 59.9	11.0	54.3
U 10	332 29.4	12.7	221 08.9	15.8	6 10.9	11.0	54.3
N 11	347 29.1	13.1	235 43.7	15.7	6 21.9	10.9	54.3
D 12	2 28.9	S22 13.4	250 18.4	15.7	N 6 32.8	10.9	54.3
A 13	17 28.6	13.8	264 53.1	15.7	6 43.7	10.9	54.3
Y 14	32 28.4	14.1	279 27.8	15.7	6 54.6	10.9	54.2
15	47 28.1	14.4	294 02.5	15.7	7 05.5	10.8	54.2
16	62 27.9	14.8	308 37.2	15.6	7 16.3	10.8	54.2
17	77 27.6	15.1	323 11.8	15.7	7 27.1	10.7	54.2
18	92 27.4	S22 15.4	337 46.5	15.6	N 7 37.8	10.8	54.2
19	107 27.1	15.8	352 21.1	15.6	7 48.6	10.7	54.2
20	122 26.9	16.1	6 55.7	15.6	7 59.3	10.6	54.2
21	137 26.6	16.4	21 30.3	15.6	8 09.9	10.7	54.2
22	152 26.4	16.7	36 04.9	15.5	8 20.6	10.6	54.2
23	167 26.1	17.1	50 39.4	15.6	8 31.2	10.5	54.2
5 00	182 25.9	S22 17.4	65 14.0	15.5	N 8 41.7	10.5	54.2
01	197 25.6	17.7	79 48.5	15.5	8 52.2	10.5	54.2
02	212 25.3	18.1	94 23.0	15.4	9 02.7	10.5	54.2
03	227 25.1	18.4	108 57.4	15.5	9 13.2	10.4	54.1
04	242 24.8	18.7	123 31.9	15.4	9 23.6	10.4	54.1
05	257 24.6	19.0	138 06.3	15.4	9 34.0	10.3	54.1
06	272 24.3	S22 19.4	152 40.7	15.3	N 9 44.3	10.3	54.1
07	287 24.1	19.7	167 15.0	15.4	9 54.6	10.3	54.1
08	302 23.8	20.0	181 49.4	15.3	10 04.9	10.2	54.1
M 09	317 23.6	20.3	196 23.7	15.3	10 15.1	10.2	54.1
O 10	332 23.3	20.6	210 58.0	15.2	10 25.3	10.1	54.1
N 11	347 23.0	21.0	225 32.2	15.2	10 35.4	10.1	54.1
D 12	2 22.8	S22 21.3	240 06.4	15.2	N10 45.5	10.1	54.1
A 13	17 22.5	21.6	254 40.6	15.2	10 55.6	10.0	54.1
Y 14	32 22.3	21.9	269 14.8	15.1	11 05.6	9.9	54.1
15	47 22.0	22.2	283 48.9	15.1	11 15.5	9.9	54.1
16	62 21.8	22.6	298 23.0	15.1	11 25.4	9.9	54.1
17	77 21.5	22.9	312 57.1	15.0	11 35.3	9.8	54.1
18	92 21.2	S22 23.2	327 31.1	15.0	N11 45.1	9.8	54.1
19	107 21.0	23.5	342 05.1	14.9	11 54.9	9.8	54.1
20	122 20.7	23.8	356 39.0	15.0	12 04.7	9.6	54.1
21	137 20.5	24.1	11 13.0	14.9	12 14.3	9.7	54.1
22	152 20.2	24.4	25 46.9	14.8	12 24.0	9.6	54.1
23	167 20.0	24.8	40 20.7	14.8	N12 33.6	9.5	54.1
	SD 16.3	d 0.3	SD	14.9		14.8	14.7

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 3	Moonrise 4	Moonrise 5	Moonrise 6
	h m	h m	h m	h m	h m	h m	h m
N 72	07 58	10 02	▬	12 14	11 57	11 38	11 12
N 70	07 41	09 19	▬	12 17	12 06	11 55	11 41
68	07 27	08 51	10 53	12 19	12 14	12 08	12 03
66	07 15	08 29	09 56	12 21	12 20	12 20	12 20
64	07 06	08 12	09 23	12 22	12 25	12 29	12 34
62	06 57	07 57	08 59	12 24	12 30	12 37	12 46
60	06 50	07 45	08 40	12 25	12 34	12 44	12 56
N 58	06 43	07 34	08 24	12 26	12 37	12 50	13 05
56	06 37	07 25	08 11	12 27	12 41	12 55	13 13
54	06 31	07 17	07 59	12 28	12 44	13 00	13 20
52	06 26	07 09	07 49	12 29	12 46	13 05	13 26
50	06 21	07 02	07 40	12 30	12 49	13 09	13 32
45	06 11	06 47	07 21	12 31	12 54	13 18	13 44
N 40	06 01	06 35	07 05	12 33	12 58	13 25	13 54
35	05 53	06 24	06 52	12 34	13 02	13 31	14 03
30	05 45	06 14	06 40	12 35	13 05	13 37	14 11
20	05 29	05 56	06 20	12 37	13 11	13 47	14 24
N 10	05 14	05 40	06 03	12 38	13 16	13 55	14 36
0	04 58	05 24	05 46	12 40	13 21	14 03	14 47
S 10	04 40	05 07	05 30	12 42	13 26	14 12	14 58
20	04 19	04 48	05 12	12 43	13 32	14 20	15 10
30	03 51	04 24	04 51	12 45	13 38	14 31	15 24
35	03 34	04 10	04 39	12 46	13 41	14 36	15 32
40	03 12	03 53	04 25	12 48	13 45	14 43	15 41
45	02 44	03 32	04 08	12 49	13 50	14 51	15 52
S 50	02 04	03 04	03 47	12 51	13 56	15 00	16 05
52	01 40	02 51	03 37	12 52	13 58	15 05	16 11
54	01 08	02 35	03 26	12 53	14 01	15 09	16 18
56	////	02 15	03 13	12 54	14 04	15 15	16 25
58	////	01 50	02 58	12 55	14 08	15 21	16 34
S 60	////	01 15	02 40	12 56	14 12	15 28	16 43

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 3	Moonset 4	Moonset 5	Moonset 6
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 37	15 42	00 15	01 59	03 46	05 41
N 70	▬	14 20	15 59	00 15	01 53	03 31	05 14
68	12 47	14 49	16 13	00 16	01 47	03 19	04 53
66	13 44	15 11	16 24	00 16	01 43	03 09	04 37
64	14 17	15 28	16 34	00 16	01 39	03 01	04 24
62	14 41	15 42	16 42	00 16	01 35	02 54	04 13
60	15 00	15 55	16 50	00 17	01 33	02 48	04 04
N 58	15 15	16 05	16 57	00 17	01 30	02 43	03 56
56	15 29	16 15	17 03	00 17	01 28	02 38	03 49
54	15 40	16 23	17 08	00 17	01 26	02 34	03 42
52	15 51	16 31	17 14	00 17	01 24	02 30	03 36
50	16 00	16 37	17 18	00 17	01 22	02 27	03 31
45	16 19	16 52	17 29	00 17	01 19	02 19	03 20
N 40	16 35	17 05	17 39	00 18	01 16	02 13	03 11
35	16 48	17 16	17 47	00 18	01 13	02 08	03 03
30	17 00	17 26	17 55	00 18	01 11	02 03	02 56
20	17 20	17 44	18 11	00 18	01 07	01 55	02 44
N 10	17 37	18 00	18 26	00 18	01 03	01 48	02 34
0	17 54	18 16	18 42	00 18	01 00	01 42	02 24
S 10	18 10	18 33	19 00	00 18	00 57	01 35	02 15
20	18 28	18 53	19 22	00 19	00 53	01 28	02 04
30	18 49	19 16	19 49	00 19	00 49	01 20	01 53
35	19 01	19 31	20 07	00 19	00 47	01 16	01 46
40	19 16	19 48	20 28	00 19	00 44	01 10	01 38
45	19 32	20 09	20 57	00 19	00 41	01 04	01 29
S 50	19 54	20 37	21 38	00 19	00 38	00 57	01 19
52	20 04	20 50	22 01	00 19	00 36	00 54	01 14
54	20 15	21 07	22 35	00 19	00 34	00 50	01 08
56	20 28	21 26	////	00 19	00 32	00 46	01 02
58	20 43	21 52	////	00 19	00 30	00 42	00 55
S 60	21 01	22 28	////	00 19	00 28	00 37	00 48

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
3	10 32	10 20	11 50	18 50	06 29	08	61
4	10 08	09 56	11 50	19 31	07 11	09	70
5	09 44	09 32	11 50	20 14	07 52	10	78

UT	ARIES	VENUS −3.9		MARS +0.7		JUPITER −2.8		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
6 00	74 26.2	151 31.0	S24 28.8	270 40.6	N 9 23.7	45 02.5	N10 33.7	229 17.0	S 7 56.5
01	89 28.7	166 30.1	28.6	285 42.0	23.4	60 05.1	33.6	244 19.2	56.6
02	104 31.2	181 29.2	28.4	300 43.5	23.0	75 07.7	33.6	259 21.4	56.7
03	119 33.6	196 28.2	. . 28.2	315 45.0	. . 22.7	90 10.4	. . 33.5	274 23.7	. . 56.7
04	134 36.1	211 27.3	27.9	330 46.5	22.3	105 13.0	33.5	289 25.9	56.8
05	149 38.6	226 26.4	27.7	345 48.0	22.0	120 15.6	33.5	304 28.2	56.9
06	164 41.0	241 25.4	S24 27.5	0 49.5	N 9 21.7	135 18.3	N10 33.4	319 30.4	S 7 57.0
07	179 43.5	256 24.5	27.3	15 51.0	21.3	150 20.9	33.4	334 32.6	57.1
08	194 46.0	271 23.6	27.1	30 52.4	21.0	165 23.5	33.3	349 34.9	57.1
T 09	209 48.4	286 22.7	. . 26.8	45 53.9	. . 20.6	180 26.1	. . 33.3	4 37.1	. . 57.2
U 10	224 50.9	301 21.7	26.6	60 55.4	20.3	195 28.8	33.2	19 39.3	57.3
E 11	239 53.3	316 20.8	26.4	75 56.9	20.0	210 31.4	33.2	34 41.6	57.4
S 12	254 55.8	331 19.9	S24 26.2	90 58.4	N 9 19.6	225 34.0	N10 33.1	49 43.8	S 7 57.4
D 13	269 58.3	346 19.0	25.9	105 59.9	19.3	240 36.6	33.1	64 46.1	57.5
A 14	285 00.7	1 18.0	25.7	121 01.4	19.0	255 39.3	33.0	79 48.3	57.6
Y 15	300 03.2	16 17.1	. . 25.5	136 02.9	. . 18.6	270 41.9	. . 33.0	94 50.5	. . 57.7
16	315 05.7	31 16.2	25.3	151 04.4	18.3	285 44.5	32.9	109 52.8	57.8
17	330 08.1	46 15.2	25.0	166 05.9	17.9	300 47.1	32.9	124 55.0	57.8
18	345 10.6	61 14.3	S24 24.8	181 07.3	N 9 17.6	315 49.8	N10 32.9	139 57.3	S 7 57.9
19	0 13.1	76 13.4	24.5	196 08.8	17.3	330 52.4	32.8	154 59.5	58.0
20	15 15.5	91 12.5	24.3	211 10.3	16.9	345 55.0	32.8	170 01.7	58.1
21	30 18.0	106 11.5	. . 24.1	226 11.8	. . 16.6	0 57.6	. . 32.7	185 04.0	. . 58.2
22	45 20.5	121 10.6	23.8	241 13.3	16.3	16 00.3	32.7	200 06.2	58.2
23	60 22.9	136 09.7	23.6	256 14.8	15.9	31 02.9	32.6	215 08.4	58.3
7 00	75 25.4	151 08.8	S24 23.4	271 16.3	N 9 15.6	46 05.5	N10 32.6	230 10.7	S 7 58.4
01	90 27.8	166 07.9	23.1	286 17.8	15.3	61 08.1	32.5	245 12.9	58.5
02	105 30.3	181 06.9	22.9	301 19.3	14.9	76 10.7	32.5	260 15.2	58.5
03	120 32.8	196 06.0	. . 22.6	316 20.8	. . 14.6	91 13.4	. . 32.4	275 17.4	. . 58.6
04	135 35.2	211 05.1	22.4	331 22.3	14.3	106 16.0	32.4	290 19.6	58.7
05	150 37.7	226 04.2	22.1	346 23.8	13.9	121 18.6	32.4	305 21.9	58.8
06	165 40.2	241 03.2	S24 21.9	1 25.3	N 9 13.6	136 21.2	N10 32.3	320 24.1	S 7 58.9
W 07	180 42.6	256 02.3	21.6	16 26.8	13.3	151 23.8	32.3	335 26.4	58.9
E 08	195 45.1	271 01.4	21.4	31 28.3	12.9	166 26.5	32.2	350 28.6	59.0
D 09	210 47.6	286 00.5	. . 21.1	46 29.8	. . 12.6	181 29.1	. . 32.2	5 30.8	. . 59.1
N 10	225 50.0	300 59.6	20.9	61 31.3	12.3	196 31.7	32.1	20 33.1	59.2
E 11	240 52.5	315 58.6	20.6	76 32.8	11.9	211 34.3	32.1	35 35.3	59.2
S 12	255 55.0	330 57.7	S24 20.3	91 34.3	N 9 11.6	226 36.9	N10 32.1	50 37.6	S 7 59.3
D 13	270 57.4	345 56.8	20.1	106 35.8	11.3	241 39.5	32.0	65 39.8	59.4
A 14	285 59.9	0 55.9	19.8	121 37.3	10.9	256 42.2	32.0	80 42.0	59.5
Y 15	301 02.3	15 55.0	. . 19.6	136 38.8	. . 10.6	271 44.8	. . 31.9	95 44.3	. . 59.6
16	316 04.8	30 54.0	19.3	151 40.3	10.3	286 47.4	31.9	110 46.5	59.6
17	331 07.3	45 53.1	19.0	166 41.8	09.9	301 50.0	31.8	125 48.8	59.7
18	346 09.7	60 52.2	S24 18.8	181 43.3	N 9 09.6	316 52.6	N10 31.8	140 51.0	S 7 59.8
19	1 12.2	75 51.3	18.5	196 44.8	09.3	331 55.2	31.8	155 53.3	59.9
20	16 14.7	90 50.4	18.2	211 46.3	08.9	346 57.9	31.7	170 55.5	7 59.9
21	31 17.1	105 49.4	. . 18.0	226 47.8	. . 08.6	2 00.5	. . 31.7	185 57.7	8 00.0
22	46 19.6	120 48.5	17.7	241 49.4	08.3	17 03.1	31.6	201 00.0	00.1
23	61 22.1	135 47.6	17.4	256 50.9	07.9	32 05.7	31.6	216 02.2	00.2
8 00	76 24.5	150 46.7	S24 17.2	271 52.4	N 9 07.6	47 08.3	N10 31.5	231 04.5	S 8 00.3
01	91 27.0	165 45.8	16.9	286 53.9	07.3	62 10.9	31.5	246 06.7	00.3
02	106 29.4	180 44.9	16.6	301 55.4	06.9	77 13.5	31.5	261 08.9	00.4
03	121 31.9	195 43.9	. . 16.3	316 56.9	. . 06.6	92 16.2	. . 31.4	276 11.2	. . 00.5
04	136 34.4	210 43.0	16.1	331 58.4	06.3	107 18.8	31.4	291 13.4	00.6
05	151 36.8	225 42.1	15.8	346 59.9	06.0	122 21.4	31.3	306 15.7	00.6
06	166 39.3	240 41.2	S24 15.5	2 01.4	N 9 05.6	137 24.0	N10 31.3	321 17.9	S 8 00.7
07	181 41.8	255 40.3	15.2	17 02.9	05.3	152 26.6	31.3	336 20.2	00.8
T 08	196 44.2	270 39.4	14.9	32 04.5	05.0	167 29.2	31.2	351 22.4	00.9
H 09	211 46.7	285 38.5	. . 14.6	47 06.0	. . 04.6	182 31.8	. . 31.2	6 24.6	. . 00.9
U 10	226 49.2	300 37.5	14.4	62 07.5	04.3	197 34.4	31.1	21 26.9	01.0
R 11	241 51.6	315 36.6	14.1	77 09.0	04.0	212 37.1	31.1	36 29.1	01.1
S 12	256 54.1	330 35.7	S24 13.8	92 10.5	N 9 03.6	227 39.7	N10 31.1	51 31.4	S 8 01.2
D 13	271 56.6	345 34.8	13.5	107 12.0	03.3	242 42.3	31.0	66 33.6	01.2
A 14	286 59.0	0 33.9	13.2	122 13.5	03.0	257 44.9	31.0	81 35.9	01.3
Y 15	302 01.5	15 33.0	. . 12.9	137 15.1	. . 02.7	272 47.5	. . 30.9	96 38.1	. . 01.4
16	317 03.9	30 32.1	12.6	152 16.6	02.3	287 50.1	30.9	111 40.3	01.5
17	332 06.4	45 31.1	12.3	167 18.1	02.0	302 52.7	30.9	126 42.6	01.6
18	347 08.9	60 30.2	S24 12.0	182 19.6	N 9 01.7	317 55.3	N10 30.8	141 44.8	S 8 01.6
19	2 11.3	75 29.3	11.7	197 21.1	01.3	332 57.9	30.8	156 47.1	01.7
20	17 13.8	90 28.4	11.4	212 22.6	01.0	348 00.5	30.7	171 49.3	01.8
21	32 16.3	105 27.5	. . 11.1	227 24.2	. . 00.7	3 03.1	. . 30.7	186 51.6	. . 01.9
22	47 18.7	120 26.6	10.8	242 25.7	00.4	18 05.7	30.7	201 53.8	01.9
23	62 21.2	135 25.7	10.5	257 27.2	00.0	33 08.4	30.6	216 56.0	02.0
Mer. Pass.	h m 18 55.2	*v* −0.9	*d* 0.3	*v* 1.5	*d* 0.3	*v* 2.6	*d* 0.0	*v* 2.2	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.5
Achernar	335 27.2	S57 10.7
Acrux	173 10.8	S63 09.7
Adhara	255 13.0	S28 59.3
Aldebaran	290 50.3	N16 32.0
Alioth	166 21.9	N55 53.4
Alkaid	153 00.1	N49 15.0
Al Na'ir	27 45.2	S46 54.3
Alnilam	275 47.1	S 1 11.7
Alphard	217 57.0	S 8 42.7
Alphecca	126 12.3	N26 40.5
Alpheratz	357 44.5	N29 09.7
Altair	62 09.6	N 8 54.2
Ankaa	353 16.6	S42 14.6
Antares	112 28.0	S26 27.4
Arcturus	145 57.0	N19 07.1
Atria	107 31.4	S69 02.8
Avior	234 18.0	S59 32.7
Bellatrix	278 32.8	N 6 21.6
Betelgeuse	271 02.1	N 7 24.5
Canopus	263 56.1	S52 42.1
Capella	280 35.6	N46 00.5
Deneb	49 32.5	N45 19.7
Denebola	182 34.8	N14 30.2
Diphda	348 56.8	S17 55.2
Dubhe	193 53.0	N61 40.8
Elnath	278 13.6	N28 37.0
Eltanin	90 47.2	N51 29.4
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.2	S29 33.6
Gacrux	172 02.4	S57 10.6
Gienah	175 53.5	S17 36.5
Hadar	148 50.0	S60 25.6
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.7
Kochab	137 20.9	N74 06.2
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.2
Menkent	148 09.2	S36 25.6
Miaplacidus	221 39.5	S69 45.8
Mirfak	308 41.4	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.3	S56 41.9
Pollux	243 28.8	N27 59.6
Procyon	245 00.6	N 5 11.5
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.6	N11 54.4
Rigel	281 12.7	S 8 11.3
Rigil Kent.	139 53.8	S60 52.8
Sabik	102 14.1	S15 44.3
Schedar	349 41.5	N56 36.5
Shaula	96 23.8	S37 06.6
Sirius	258 34.3	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.0	S43 28.7
Vega	80 40.1	N38 47.9
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	75 43.4	13 56
Mars	195 50.9	5 54
Jupiter	330 40.1	20 52
Saturn	154 45.3	8 38

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
6 00	182 19.7	S22 25.1	54 54.5	14.8	N12 43.1	9.5	54.1
01	197 19.4	25.4	69 28.3	14.7	12 52.6	9.4	54.1
02	212 19.2	25.7	84 02.0	14.7	13 02.0	9.4	54.1
03	227 18.9	26.0	98 35.7	14.7	13 11.4	9.3	54.1
04	242 18.7	26.3	113 09.4	14.6	13 20.7	9.3	54.1
05	257 18.4	26.6	127 43.0	14.6	13 30.0	9.2	54.1
06	272 18.1	S22 26.9	142 16.6	14.5	N13 39.2	9.2	54.1
07	287 17.9	27.2	156 50.1	14.5	13 48.4	9.1	54.1
T 08	302 17.6	27.5	171 23.6	14.5	13 57.5	9.1	54.1
U 09	317 17.4	27.8	185 57.1	14.4	14 06.6	9.0	54.1
E 10	332 17.1	28.1	200 30.5	14.3	14 15.6	8.9	54.1
S 11	347 16.8	28.4	215 03.8	14.3	14 24.5	8.9	54.1
D 12	2 16.6	S22 28.7	229 37.1	14.3	N14 33.4	8.8	54.1
A 13	17 16.3	29.0	244 10.4	14.3	14 42.2	8.8	54.1
Y 14	32 16.0	29.3	258 43.7	14.1	14 51.0	8.7	54.1
15	47 15.8	29.6	273 16.8	14.2	14 59.7	8.6	54.1
16	62 15.5	29.9	287 50.0	14.1	15 08.3	8.6	54.1
17	77 15.3	30.2	302 23.1	14.0	15 16.9	8.6	54.1
18	92 15.0	S22 30.5	316 56.1	14.0	N15 25.5	8.4	54.1
19	107 14.7	30.8	331 29.1	14.0	15 33.9	8.4	54.1
20	122 14.5	31.1	346 02.1	13.9	15 42.3	8.4	54.1
21	137 14.2	31.4	0 35.0	13.8	15 50.7	8.2	54.1
22	152 13.9	31.7	15 07.8	13.8	15 58.9	8.2	54.1
23	167 13.7	32.0	29 40.6	13.8	16 07.1	8.2	54.1
7 00	182 13.4	S22 32.3	44 13.4	13.7	N16 15.3	8.0	54.1
01	197 13.1	32.6	58 46.1	13.6	16 23.3	8.0	54.2
02	212 12.9	32.9	73 18.7	13.7	16 31.3	8.0	54.2
03	227 12.6	33.2	87 51.4	13.5	16 39.3	7.8	54.2
04	242 12.3	33.4	102 23.9	13.5	16 47.1	7.8	54.2
05	257 12.1	33.7	116 56.4	13.5	16 54.9	7.8	54.2
06	272 11.8	S22 34.0	131 28.9	13.4	N17 02.7	7.6	54.2
W 07	287 11.5	34.3	146 01.3	13.3	17 10.3	7.6	54.2
E 08	302 11.3	34.6	160 33.6	13.3	17 17.9	7.5	54.2
D 09	317 11.0	34.9	175 05.9	13.3	17 25.4	7.5	54.2
N 10	332 10.7	35.2	189 38.2	13.2	17 32.9	7.3	54.2
E 11	347 10.5	35.4	204 10.4	13.1	17 40.2	7.3	54.2
S 12	2 10.2	S22 35.7	218 42.5	13.1	N17 47.5	7.2	54.2
D 13	17 09.9	36.0	233 14.6	13.1	17 54.7	7.2	54.2
A 14	32 09.7	36.3	247 46.7	13.0	18 01.9	7.0	54.2
Y 15	47 09.4	36.6	262 18.7	12.9	18 08.9	7.0	54.2
16	62 09.1	36.9	276 50.6	12.9	18 15.9	6.9	54.3
17	77 08.9	37.1	291 22.5	12.8	18 22.8	6.8	54.3
18	92 08.6	S22 37.4	305 54.3	12.8	N18 29.6	6.8	54.3
19	107 08.3	37.7	320 26.1	12.7	18 36.4	6.7	54.3
20	122 08.1	38.0	334 57.8	12.7	18 43.1	6.5	54.3
21	137 07.8	38.2	349 29.5	12.6	18 49.6	6.6	54.3
22	152 07.5	38.5	4 01.1	12.6	18 56.2	6.4	54.3
23	167 07.3	38.8	18 32.7	12.5	19 02.6	6.3	54.3
8 00	182 07.0	S22 39.1	33 04.2	12.5	N19 08.9	6.3	54.3
01	197 06.7	39.3	47 35.7	12.4	19 15.2	6.1	54.3
02	212 06.4	39.6	62 07.1	12.4	19 21.3	6.1	54.3
03	227 06.2	39.9	76 38.5	12.3	19 27.4	6.0	54.4
04	242 05.9	40.2	91 09.8	12.2	19 33.4	5.9	54.4
05	257 05.6	40.4	105 41.0	12.2	19 39.3	5.9	54.4
06	272 05.4	S22 40.7	120 12.2	12.2	N19 45.2	5.7	54.4
07	287 05.1	41.0	134 43.4	12.1	19 50.9	5.7	54.4
T 08	302 04.8	41.2	149 14.5	12.0	19 56.6	5.5	54.4
H 09	317 04.5	41.5	163 45.5	12.0	20 02.1	5.5	54.4
U 10	332 04.3	41.8	178 16.5	11.9	20 07.6	5.4	54.4
R 11	347 04.0	42.0	192 47.4	11.9	20 13.0	5.3	54.4
S 12	2 03.7	S22 42.3	207 18.3	11.9	N20 18.3	5.2	54.5
D 13	17 03.5	42.6	221 49.2	11.7	20 23.5	5.1	54.5
A 14	32 03.2	42.8	236 19.9	11.8	20 28.6	5.0	54.5
Y 15	47 02.9	43.1	250 50.7	11.7	20 33.6	4.9	54.5
16	62 02.6	43.3	265 21.4	11.6	20 38.5	4.8	54.5
17	77 02.4	43.6	279 52.0	11.6	20 43.3	4.8	54.5
18	92 02.1	S22 43.9	294 22.6	11.5	N20 48.1	4.6	54.5
19	107 01.8	44.1	308 53.1	11.5	20 52.7	4.5	54.5
20	122 01.5	44.4	323 23.6	11.4	20 57.2	4.5	54.6
21	137 01.3	44.6	337 54.0	11.4	21 01.7	4.3	54.6
22	152 01.0	44.9	352 24.4	11.4	21 06.0	4.2	54.6
23	167 00.7	45.1	6 54.8	11.3	N21 10.2	4.2	54.6
	SD 16.3	d 0.3	SD 14.7		14.8		14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 6	Moonrise 7	Moonrise 8	Moonrise 9
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 05	10 16	▬	11 12	10 18	▭	▭
N 70	07 47	09 28	▬	11 41	11 21	▭	▭
68	07 33	08 58	11 15	12 03	11 57	11 48	11 29
66	07 21	08 35	10 06	12 20	12 22	12 28	12 42
64	07 10	08 17	09 30	12 34	12 42	12 55	13 19
62	07 02	08 02	09 05	12 46	12 58	13 17	13 45
60	06 54	07 50	08 45	12 56	13 12	13 34	14 06
N 58	06 47	07 39	08 29	13 05	13 24	13 49	14 23
56	06 41	07 29	08 15	13 13	13 34	14 01	14 37
54	06 35	07 20	08 03	13 20	13 43	14 12	14 49
52	06 29	07 13	07 53	13 26	13 51	14 22	15 00
50	06 25	07 06	07 44	13 32	13 58	14 30	15 10
45	06 14	06 50	07 24	13 44	14 14	14 49	15 30
N 40	06 04	06 38	07 08	13 54	14 27	15 04	15 47
35	05 55	06 26	06 54	14 03	14 38	15 17	16 01
30	05 47	06 16	06 42	14 11	14 47	15 28	16 13
20	05 31	05 58	06 22	14 24	15 04	15 47	16 34
N 10	05 15	05 42	06 04	14 36	15 18	16 04	16 52
0	04 59	05 25	05 48	14 47	15 32	16 20	17 09
S 10	04 41	05 08	05 31	14 58	15 46	16 35	17 26
20	04 19	04 48	05 13	15 10	16 01	16 52	17 45
30	03 51	04 24	04 51	15 24	16 18	17 12	18 06
35	03 33	04 10	04 39	15 32	16 28	17 23	18 18
40	03 11	03 52	04 25	15 41	16 39	17 37	18 32
45	02 42	03 31	04 07	15 52	16 52	17 52	18 49
S 50	02 00	03 03	03 46	16 05	17 09	18 11	19 10
52	01 36	02 48	03 36	16 11	17 17	18 20	19 20
54	01 01	02 32	03 24	16 18	17 25	18 31	19 31
56	////	02 12	03 11	16 25	17 35	18 42	19 44
58	////	01 46	02 55	16 34	17 46	18 56	19 59
S 60	////	01 07	02 37	16 43	17 59	19 11	20 17

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 6	Moonset 7	Moonset 8	Moonset 9
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 27	15 37	05 41	08 08	▭	▭
N 70	▬	14 14	15 55	05 14	07 07	▭	▭
68	12 27	14 44	16 10	04 53	06 32	08 18	10 19
66	13 37	15 07	16 22	04 37	06 07	07 38	09 06
64	14 12	15 25	16 32	04 24	05 48	07 11	08 29
62	14 37	15 40	16 41	04 13	05 33	06 51	08 03
60	14 57	15 53	16 48	04 04	05 19	06 34	07 43
N 58	15 13	16 04	16 55	03 56	05 08	06 19	07 26
56	15 27	16 13	17 02	03 49	04 59	06 07	07 12
54	15 39	16 22	17 08	03 42	04 50	05 57	07 00
52	15 49	16 30	17 13	03 36	04 42	05 47	06 49
50	15 59	16 37	17 18	03 31	04 36	05 39	06 40
45	16 18	16 52	17 29	03 20	04 21	05 21	06 20
N 40	16 35	17 05	17 39	03 11	04 09	05 07	06 04
35	16 48	17 16	17 48	03 03	03 59	04 55	05 50
30	17 00	17 26	17 56	02 56	03 50	04 44	05 38
20	17 20	17 44	18 12	02 44	03 34	04 26	05 18
N 10	17 38	18 01	18 27	02 34	03 21	04 10	05 00
0	17 55	18 17	18 44	02 24	03 08	03 55	04 43
S 10	18 12	18 35	19 02	02 15	02 56	03 40	04 27
20	18 30	18 55	19 24	02 04	02 43	03 24	04 09
30	18 51	19 19	19 52	01 53	02 28	03 06	03 49
35	19 04	19 33	20 10	01 46	02 19	02 56	03 37
40	19 18	19 51	20 32	01 38	02 09	02 44	03 23
45	19 36	20 12	21 01	01 29	01 57	02 29	03 07
S 50	19 57	20 41	21 43	01 19	01 43	02 12	02 48
52	20 07	20 55	22 08	01 14	01 36	02 04	02 38
54	20 19	21 12	22 44	01 08	01 29	01 55	02 28
56	20 33	21 32	////	01 02	01 21	01 45	02 16
58	20 48	21 59	////	00 55	01 12	01 33	02 02
S 60	21 07	22 38	////	00 48	01 02	01 20	01 46

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
6	09 19	09 07	11 51	20 58	08 35	11	85
7	08 54	08 41	11 51	21 43	09 20	12	91
8	08 28	08 15	11 52	22 31	10 07	13	96

UT	ARIES	VENUS −3.9		MARS +0.6		JUPITER −2.7		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
9 00	77 23.7	150 24.8	S24 10.2	272 28.7	N 8 59.7	48 11.0	N10 30.6	231 58.3	S 8 02.1
01	92 26.1	165 23.9	09.9	287 30.2	59.4	63 13.6	30.5	247 00.5	02.2
02	107 28.6	180 23.0	09.6	302 31.8	59.1	78 16.2	30.5	262 02.8	02.2
03	122 31.1	195 22.0	09.3	317 33.3	58.7	93 18.8	30.5	277 05.0	02.3
04	137 33.5	210 21.1	09.0	332 34.8	58.4	108 21.4	30.4	292 07.3	02.4
05	152 36.0	225 20.2	08.7	347 36.3	58.1	123 24.0	30.4	307 09.5	02.5
06	167 38.4	240 19.3	S24 08.4	2 37.8	N 8 57.8	138 26.6	N10 30.3	322 11.8	S 8 02.5
07	182 40.9	255 18.4	08.1	17 39.4	57.4	153 29.2	30.3	337 14.0	02.6
08	197 43.4	270 17.5	07.8	32 40.9	57.1	168 31.8	30.3	352 16.2	02.7
F 09	212 45.8	285 16.6	07.4	47 42.4	56.8	183 34.4	30.2	7 18.5	02.8
R 10	227 48.3	300 15.7	07.1	62 43.9	56.5	198 37.0	30.2	22 20.7	02.8
I 11	242 50.8	315 14.8	06.8	77 45.5	56.1	213 39.6	30.2	37 23.0	02.9
D 12	257 53.2	330 13.9	S24 06.5	92 47.0	N 8 55.8	228 42.2	N10 30.1	52 25.2	S 8 03.0
A 13	272 55.7	345 13.0	06.2	107 48.5	55.5	243 44.8	30.1	67 27.5	03.1
Y 14	287 58.2	0 12.1	05.9	122 50.1	55.2	258 47.4	30.0	82 29.7	03.1
15	303 00.6	15 11.2	05.5	137 51.6	54.8	273 50.0	30.0	97 32.0	03.2
16	318 03.1	30 10.3	05.2	152 53.1	54.5	288 52.6	30.0	112 34.2	03.3
17	333 05.6	45 09.4	04.9	167 54.6	54.2	303 55.2	29.9	127 36.5	03.4
18	348 08.0	60 08.4	S24 04.6	182 56.2	N 8 53.9	318 57.8	N10 29.9	142 38.7	S 8 03.4
19	3 10.5	75 07.5	04.2	197 57.7	53.6	334 00.4	29.9	157 40.9	03.5
20	18 12.9	90 06.6	03.9	212 59.2	53.2	349 03.0	29.8	172 43.2	03.6
21	33 15.4	105 05.7	03.6	228 00.8	52.9	4 05.6	29.8	187 45.4	03.7
22	48 17.9	120 04.8	03.2	243 02.3	52.6	19 08.2	29.7	202 47.7	03.7
23	63 20.3	135 03.9	02.9	258 03.8	52.3	34 10.8	29.7	217 49.9	03.8
10 00	78 22.8	150 03.0	S24 02.6	273 05.4	N 8 51.9	49 13.4	N10 29.7	232 52.2	S 8 03.9
01	93 25.3	165 02.1	02.2	288 06.9	51.6	64 16.0	29.6	247 54.4	04.0
02	108 27.7	180 01.2	01.9	303 08.4	51.3	79 18.6	29.6	262 56.7	04.0
03	123 30.2	195 00.3	01.6	318 10.0	51.0	94 21.2	29.6	277 58.9	04.1
04	138 32.7	209 59.4	01.2	333 11.5	50.7	109 23.8	29.5	293 01.2	04.2
05	153 35.1	224 58.5	00.9	348 13.0	50.3	124 26.4	29.5	308 03.4	04.3
06	168 37.6	239 57.6	S24 00.6	3 14.6	N 8 50.0	139 29.0	N10 29.5	323 05.7	S 8 04.3
07	183 40.1	254 56.7	24 00.2	18 16.1	49.7	154 31.6	29.4	338 07.9	04.4
S 08	198 42.5	269 55.8	23 59.9	33 17.6	49.4	169 34.2	29.4	353 10.2	04.5
A 09	213 45.0	284 54.9	59.5	48 19.2	49.1	184 36.8	29.4	8 12.4	04.6
T 10	228 47.4	299 54.0	59.2	63 20.7	48.7	199 39.4	29.3	23 14.7	04.6
U 11	243 49.9	314 53.1	58.8	78 22.2	48.4	214 42.0	29.3	38 16.9	04.7
R 12	258 52.4	329 52.2	S23 58.5	93 23.8	N 8 48.1	229 44.6	N10 29.3	53 19.1	S 8 04.8
D 13	273 54.8	344 51.3	58.1	108 25.3	47.8	244 47.2	29.2	68 21.4	04.9
A 14	288 57.3	359 50.4	57.8	123 26.9	47.5	259 49.8	29.2	83 23.6	04.9
Y 15	303 59.8	14 49.5	57.4	138 28.4	47.1	274 52.4	29.1	98 25.9	05.0
16	319 02.2	29 48.6	57.1	153 29.9	46.8	289 55.0	29.1	113 28.1	05.1
17	334 04.7	44 47.7	56.7	168 31.5	46.5	304 57.5	29.1	128 30.4	05.2
18	349 07.2	59 46.8	S23 56.4	183 33.0	N 8 46.2	320 00.1	N10 29.0	143 32.6	S 8 05.2
19	4 09.6	74 46.0	56.0	198 34.6	45.9	335 02.7	29.0	158 34.9	05.3
20	19 12.1	89 45.1	55.6	213 36.1	45.5	350 05.3	29.0	173 37.1	05.4
21	34 14.5	104 44.2	55.3	228 37.7	45.2	5 07.9	28.9	188 39.4	05.5
22	49 17.0	119 43.3	54.9	243 39.2	44.9	20 10.5	28.9	203 41.6	05.5
23	64 19.5	134 42.4	54.6	258 40.7	44.6	35 13.1	28.9	218 43.9	05.6
11 00	79 21.9	149 41.5	S23 54.2	273 42.3	N 8 44.3	50 15.7	N10 28.8	233 46.1	S 8 05.7
01	94 24.4	164 40.6	53.8	288 43.8	44.0	65 18.3	28.8	248 48.4	05.7
02	109 26.9	179 39.7	53.5	303 45.4	43.6	80 20.9	28.8	263 50.6	05.8
03	124 29.3	194 38.8	53.1	318 46.9	43.3	95 23.5	28.7	278 52.9	05.9
04	139 31.8	209 37.9	52.7	333 48.5	43.0	110 26.0	28.7	293 55.1	06.0
05	154 34.3	224 37.0	52.4	348 50.0	42.7	125 28.6	28.7	308 57.4	06.0
06	169 36.7	239 36.1	S23 52.0	3 51.6	N 8 42.4	140 31.2	N10 28.6	323 59.6	S 8 06.1
07	184 39.2	254 35.2	51.6	18 53.1	42.1	155 33.8	28.6	339 01.9	06.2
08	199 41.7	269 34.3	51.3	33 54.7	41.7	170 36.4	28.6	354 04.1	06.3
S 09	214 44.1	284 33.5	50.9	48 56.2	41.4	185 39.0	28.6	9 06.4	06.3
U 10	229 46.6	299 32.6	50.5	63 57.8	41.1	200 41.6	28.5	24 08.6	06.4
N 11	244 49.0	314 31.7	50.1	78 59.3	40.8	215 44.2	28.5	39 10.9	06.5
D 12	259 51.5	329 30.8	S23 49.7	94 00.9	N 8 40.5	230 46.8	N10 28.5	54 13.1	S 8 06.6
A 13	274 54.0	344 29.9	49.4	109 02.4	40.2	245 49.3	28.4	69 15.4	06.6
Y 14	289 56.4	359 29.0	49.0	124 04.0	39.9	260 51.9	28.4	84 17.6	06.7
15	304 58.9	14 28.1	48.6	139 05.5	39.5	275 54.5	28.4	99 19.9	06.8
16	320 01.4	29 27.2	48.2	154 07.1	39.2	290 57.1	28.3	114 22.1	06.8
17	335 03.8	44 26.3	47.8	169 08.6	38.9	305 59.7	28.3	129 24.4	06.9
18	350 06.3	59 25.5	S23 47.5	184 10.2	N 8 38.6	321 02.3	N10 28.3	144 26.6	S 8 07.0
19	5 08.8	74 24.6	47.1	199 11.8	38.3	336 04.9	28.2	159 28.9	07.1
20	20 11.2	89 23.7	46.7	214 13.3	38.0	351 07.4	28.2	174 31.1	07.1
21	35 13.7	104 22.8	46.3	229 14.9	37.7	6 10.0	28.2	189 33.4	07.2
22	50 16.2	119 21.9	45.9	244 16.4	37.4	21 12.6	28.1	204 35.6	07.3
23	65 18.6	134 21.0	45.5	259 18.0	37.0	36 15.2	28.1	219 37.9	07.4
	h m								
Mer. Pass.	18 43.4	v −0.9	d 0.3	v 1.5	d 0.3	v 2.6	d 0.0	v 2.2	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.5
Achernar	335 27.2	S57 10.7
Acrux	173 10.7	S63 09.7
Adhara	255 13.0	S28 59.3
Aldebaran	290 50.3	N16 32.0
Alioth	166 21.8	N55 53.4
Alkaid	153 00.0	N49 15.0
Al Na'ir	27 45.2	S46 54.3
Alnilam	275 47.1	S 1 11.7
Alphard	217 57.0	S 8 42.7
Alphecca	126 12.3	N26 40.4
Alpheratz	357 44.5	N29 09.7
Altair	62 09.6	N 8 54.2
Ankaa	353 16.6	S42 14.6
Antares	112 28.0	S26 27.4
Arcturus	145 57.0	N19 07.1
Atria	107 31.3	S69 02.8
Avior	234 18.0	S59 32.8
Bellatrix	278 32.8	N 6 21.6
Betelgeuse	271 02.1	N 7 24.5
Canopus	263 56.1	S52 42.1
Capella	280 35.5	N46 00.5
Deneb	49 32.5	N45 19.7
Denebola	182 34.8	N14 30.1
Diphda	348 56.8	S17 55.3
Dubhe	193 52.9	N61 40.8
Elnath	278 13.6	N28 37.0
Eltanin	90 47.2	N51 29.4
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.2	S29 33.6
Gacrux	172 02.3	S57 10.6
Gienah	175 53.5	S17 36.5
Hadar	148 49.9	S60 25.6
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 20.9	N74 06.2
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.2
Menkent	148 09.1	S36 25.6
Miaplacidus	221 39.4	S69 45.8
Mirfak	308 41.4	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.3	S56 41.8
Pollux	243 28.7	N27 59.6
Procyon	245 00.6	N 5 11.5
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.6	N11 54.3
Rigel	281 12.7	S 8 11.3
Rigil Kent.	139 53.7	S60 52.8
Sabik	102 14.1	S15 44.3
Schedar	349 41.5	N56 36.5
Shaula	96 23.8	S37 06.6
Sirius	258 34.3	S16 44.0
Spica	158 32.6	S11 13.4
Suhail	222 53.0	S43 28.8
Vega	80 40.1	N38 47.9
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	71 40.2	14 01
Mars	194 42.6	5 47
Jupiter	330 50.6	20 40
Saturn	154 29.4	8 27

UT	SUN		MOON				
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
9 00	182 00.4	S22 45.4	21 25.1	11.2	N21 14.4	4.0	54.6
01	197 00.2	45.7	35 55.3	11.2	21 18.4	4.0	54.6
02	211 59.9	45.9	50 25.5	11.2	21 22.4	3.8	54.6
03	226 59.6	46.2	64 55.7	11.1	21 26.2	3.8	54.6
04	241 59.3	46.4	79 25.8	11.0	21 30.0	3.6	54.7
05	256 59.1	46.7	93 55.8	11.0	21 33.6	3.5	54.7
06	271 58.8	S22 46.9	108 25.8	11.0	N21 37.1	3.5	54.7
07	286 58.5	47.2	122 55.8	10.9	21 40.6	3.3	54.7
08	301 58.2	47.4	137 25.7	10.9	21 43.9	3.2	54.7
F 09	316 58.0	47.7	151 55.6	10.9	21 47.1	3.2	54.7
R 10	331 57.7	47.9	166 25.5	10.8	21 50.3	3.0	54.7
I 11	346 57.4	48.2	180 55.3	10.7	21 53.3	2.9	54.8
D 12	1 57.1	S22 48.4	195 25.0	10.8	N21 56.2	2.8	54.8
A 13	16 56.9	48.7	209 54.8	10.6	21 59.0	2.7	54.8
Y 14	31 56.6	48.9	224 24.4	10.7	22 01.7	2.6	54.8
15	46 56.3	49.1	238 54.1	10.6	22 04.3	2.5	54.8
16	61 56.0	49.4	253 23.7	10.5	22 06.8	2.3	54.8
17	76 55.7	49.6	267 53.2	10.6	22 09.1	2.3	54.8
18	91 55.5	S22 49.9	282 22.8	10.5	N22 11.4	2.2	54.9
19	106 55.2	50.1	296 52.3	10.4	22 13.6	2.0	54.9
20	121 54.9	50.3	311 21.7	10.4	22 15.6	1.9	54.9
21	136 54.6	50.6	325 51.1	10.4	22 17.5	1.9	54.9
22	151 54.4	50.8	340 20.5	10.4	22 19.4	1.7	54.9
23	166 54.1	51.1	354 49.9	10.3	22 21.1	1.6	54.9
10 00	181 53.8	S22 51.3	9 19.2	10.3	N22 22.7	1.5	55.0
01	196 53.5	51.5	23 48.5	10.2	22 24.2	1.4	55.0
02	211 53.2	51.8	38 17.7	10.2	22 25.6	1.2	55.0
03	226 53.0	52.0	52 46.9	10.2	22 26.8	1.2	55.0
04	241 52.7	52.2	67 16.1	10.2	22 28.0	1.0	55.0
05	256 52.4	52.5	81 45.3	10.1	22 29.0	1.0	55.0
06	271 52.1	S22 52.7	96 14.4	10.1	N22 30.0	0.8	55.1
07	286 51.8	52.9	110 43.5	10.1	22 30.8	0.7	55.1
S 08	301 51.6	53.2	125 12.6	10.1	22 31.5	0.6	55.1
A 09	316 51.3	53.4	139 41.7	10.0	22 32.1	0.4	55.1
T 10	331 51.0	53.6	154 10.7	10.0	22 32.5	0.4	55.1
U 11	346 50.7	53.8	168 39.7	10.0	22 32.9	0.2	55.1
R 12	1 50.4	S22 54.1	183 08.7	10 0	N22 33.1	0.2	55.2
D 13	16 50.1	54.3	197 37.7	9.9	22 33.3	0.0	55.2
A 14	31 49.9	54.5	212 06.6	9.9	22 33.3	0.1	55.2
Y 15	46 49.6	54.7	226 35.5	9.9	22 33.2	0.3	55.2
16	61 49.3	55.0	241 04.4	9.9	22 32.9	0.3	55.2
17	76 49.0	55.2	255 33.3	9.9	22 32.6	0.5	55.2
18	91 48.7	S22 55.4	270 02.2	9.8	N22 32.1	0.5	55.3
19	106 48.5	55.6	284 31.0	9.9	22 31.6	0.7	55.3
20	121 48.2	55.9	298 59.9	9.8	22 30.9	0.8	55.3
21	136 47.9	56.1	313 28.7	9.8	22 30.1	0.9	55.3
22	151 47.6	56.3	327 57.5	9.8	22 29.2	1.1	55.3
23	166 47.3	56.5	342 26.3	9.8	22 28.1	1.1	55.3
11 00	181 47.0	S22 56.7	356 55.1	9.7	N22 27.0	1.3	55.4
01	196 46.8	57.0	11 23.8	9.8	22 25.7	1.4	55.4
02	211 46.5	57.2	25 52.6	9.7	22 24.3	1.5	55.4
03	226 46.2	57.4	40 21.3	9.8	22 22.8	1.6	55.4
04	241 45.9	57.6	54 50.1	9.7	22 21.2	1.8	55.4
05	256 45.6	57.8	69 18.8	9.7	22 19.4	1.8	55.4
06	271 45.3	S22 58.0	83 47.5	9.8	N22 17.6	2.0	55.5
07	286 45.0	58.2	98 16.3	9.7	22 15.6	2.1	55.5
08	301 44.8	58.5	112 45.0	9.7	22 13.5	2.2	55.5
S 09	316 44.5	58.7	127 13.7	9.7	22 11.3	2.3	55.5
U 10	331 44.2	58.9	141 42.4	9.7	22 09.0	2.5	55.5
N 11	346 43.9	59.1	156 11.1	9.7	22 06.5	2.5	55.6
D 12	1 43.6	S22 59.3	170 39.8	9.7	N22 04.0	2.7	55.6
A 13	16 43.3	59.5	185 08.5	9.7	22 01.3	2.8	55.6
Y 14	31 43.0	59.7	199 37.2	9.7	21 58.5	2.9	55.6
15	46 42.8	22 59.9	214 05.9	9.7	21 55.6	3.1	55.6
16	61 42.5	23 00.1	228 34.6	9.7	21 52.5	3.1	55.7
17	76 42.2	00.3	243 03.3	9.7	21 49.4	3.3	55.7
18	91 41.9	S23 00.5	257 32.0	9.8	N21 46.1	3.4	55.7
19	106 41.6	00.7	272 00.8	9.7	21 42.7	3.4	55.7
20	121 41.3	00.9	286 29.5	9.7	21 39.3	3.7	55.7
21	136 41.0	01.1	300 58.2	9.7	21 35.6	3.7	55.7
22	151 40.8	01.3	315 26.9	9.8	21 31.9	3.8	55.8
23	166 40.5	01.5	329 55.7	9.8	N21 28.1	4.0	55.8
	SD 16.3	d 0.2	SD	14.9	15.0		15.1

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 9	Moonrise 10	Moonrise 11	Moonrise 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 11	10 28	▬	▭	▭	▭	▭
N 70	07 53	09 36	▬	▭	▭	▭	▭
68	07 38	09 04	▬	11 29	▭	13 01	15 16
66	07 25	08 41	10 14	12 42	13 18	14 26	15 56
64	07 15	08 22	09 37	13 19	14 00	15 03	16 24
62	07 06	08 07	09 11	13 45	14 29	15 30	16 46
60	06 57	07 54	08 50	14 06	14 51	15 50	17 03
N 58	06 50	07 42	08 33	14 23	15 08	16 07	17 17
56	06 44	07 33	08 19	14 37	15 23	16 22	17 29
54	06 38	07 24	08 07	14 49	15 36	16 34	17 40
52	06 33	07 16	07 56	15 00	15 48	16 45	17 50
50	06 27	07 09	07 47	15 10	15 58	16 54	17 58
45	06 16	06 53	07 27	15 30	16 19	17 15	18 16
N 40	06 06	06 40	07 10	15 47	16 36	17 31	18 31
35	05 57	06 29	06 57	16 01	16 50	17 45	18 43
30	05 49	06 18	06 45	16 13	17 03	17 57	18 54
20	05 33	06 00	06 24	16 34	17 24	18 18	19 13
N 10	05 17	05 43	06 06	16 52	17 43	18 35	19 29
0	05 00	05 26	05 49	17 09	18 00	18 52	19 44
S 10	04 42	05 09	05 32	17 26	18 18	19 09	19 59
20	04 20	04 49	05 13	17 45	18 36	19 27	20 15
30	03 51	04 25	04 52	18 06	18 58	19 47	20 33
35	03 33	04 10	04 39	18 18	19 10	19 59	20 44
40	03 11	03 52	04 24	18 32	19 25	20 13	20 56
45	02 41	03 30	04 07	18 49	19 42	20 29	21 10
S 50	01 58	03 01	03 45	19 10	20 03	20 49	21 28
52	01 33	02 47	03 35	19 20	20 13	20 59	21 36
54	00 54	02 30	03 23	19 31	20 25	21 09	21 45
56	////	02 09	03 09	19 44	20 38	21 21	21 55
58	////	01 42	02 53	19 59	20 53	21 35	22 07
S 60	////	01 00	02 34	20 17	21 11	21 52	22 21

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 9	Moonset 10	Moonset 11	Moonset 12
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 17	15 34	▭	▭	▭	▭
N 70	▬	14 09	15 52	▭	▭	▭	▭
68	▬	14 41	16 07	10 19	▭	12 21	11 54
66	13 30	15 04	16 20	09 06	10 16	10 56	11 13
64	14 08	15 23	16 30	08 29	09 34	10 18	10 44
62	14 34	15 38	16 39	08 03	09 05	09 51	10 22
60	14 55	15 51	16 47	07 43	08 43	09 30	10 05
N 58	15 12	16 03	16 55	07 26	08 25	09 13	09 50
56	15 26	16 12	17 01	07 12	08 10	08 59	09 37
54	15 38	16 21	17 07	07 00	07 57	08 46	09 26
52	15 49	16 29	17 13	06 49	07 46	08 35	09 16
50	15 58	16 36	17 18	06 40	07 36	08 26	09 08
45	16 18	16 52	17 29	06 20	07 15	08 05	08 49
N 40	16 35	17 05	17 39	06 04	06 58	07 48	08 34
35	16 48	17 16	17 48	05 50	06 43	07 34	08 21
30	17 01	17 27	17 57	05 38	06 31	07 22	08 09
20	17 21	17 45	18 13	05 18	06 10	07 01	07 50
N 10	17 39	18 02	18 28	05 00	05 51	06 42	07 33
0	17 56	18 19	18 45	04 43	05 34	06 25	07 17
S 10	18 14	18 37	19 04	04 27	05 16	06 08	07 01
20	18 32	18 57	19 26	04 09	04 58	05 50	06 44
30	18 54	19 21	19 54	03 49	04 36	05 28	06 24
35	19 06	19 36	20 12	03 37	04 24	05 16	06 12
40	19 21	19 54	20 35	03 23	04 09	05 02	05 59
45	19 39	20 16	21 05	03 07	03 52	04 44	05 43
S 50	20 00	20 44	21 48	02 48	03 31	04 23	05 24
52	20 11	20 59	22 14	02 38	03 21	04 13	05 15
54	20 23	21 16	22 54	02 28	03 10	04 02	05 04
56	20 37	21 37	////	02 16	02 57	03 49	04 52
58	20 53	22 05	////	02 02	02 42	03 34	04 39
S 60	21 12	22 48	////	01 46	02 24	03 16	04 23

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
9	08 02	07 49	11 52	23 21	10 56	14	99
10	07 36	07 22	11 53	24 13	11 47	15	100
11	07 09	06 55	11 53	00 13	12 39	16	99

UT	ARIES	VENUS −3.9		MARS +0.6		JUPITER −2.7		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
12 00	80 21.1	149 20.1	S23 45.1	274 19.5	N 8 36.7	51 17.8	N10 28.1	234 40.1	S 8 07.4
01	95 23.5	164 19.3	44.7	289 21.1	36.4	66 20.4	28.1	249 42.4	07.5
02	110 26.0	179 18.4	44.3	304 22.7	36.1	81 22.9	28.0	264 44.6	07.6
03	125 28.5	194 17.5	43.9	319 24.2	35.8	96 25.5	28.0	279 46.9	07.6
04	140 30.9	209 16.6	43.5	334 25.8	35.5	111 28.1	28.0	294 49.1	07.7
05	155 33.4	224 15.7	43.1	349 27.3	35.2	126 30.7	27.9	309 51.4	07.8
06	170 35.9	239 14.8	S23 42.7	4 28.9	N 8 34.9	141 33.3	N10 27.9	324 53.6	S 8 07.9
07	185 38.3	254 14.0	42.3	19 30.5	34.6	156 35.8	27.9	339 55.9	07.9
08	200 40.8	269 13.1	41.9	34 32.0	34.2	171 38.4	27.8	354 58.2	08.0
M 09	215 43.3	284 12.2	41.5	49 33.6	33.9	186 41.0	27.8	10 00.4	08.1
O 10	230 45.7	299 11.3	41.1	64 35.1	33.6	201 43.6	27.8	25 02.7	08.1
N 11	245 48.2	314 10.4	40.7	79 36.7	33.3	216 46.2	27.8	40 04.9	08.2
D 12	260 50.7	329 09.6	S23 40.3	94 38.3	N 8 33.0	231 48.7	N10 27.7	55 07.2	S 8 08.3
A 13	275 53.1	344 08.7	39.9	109 39.8	32.7	246 51.3	27.7	70 09.4	08.4
Y 14	290 55.6	359 07.8	39.5	124 41.4	32.4	261 53.9	27.7	85 11.7	08.4
15	305 58.0	14 06.9	39.1	139 43.0	32.1	276 56.5	27.6	100 13.9	08.5
16	321 00.5	29 06.0	38.7	154 44.5	31.8	291 59.1	27.6	115 16.2	08.6
17	336 03.0	44 05.2	38.2	169 46.1	31.5	307 01.6	27.6	130 18.4	08.7
18	351 05.4	59 04.3	S23 37.8	184 47.7	N 8 31.2	322 04.2	N10 27.6	145 20.7	S 8 08.7
19	6 07.9	74 03.4	37.4	199 49.2	30.8	337 06.8	27.5	160 22.9	08.8
20	21 10.4	89 02.5	37.0	214 50.8	30.5	352 09.4	27.5	175 25.2	08.9
21	36 12.8	104 01.6	36.6	229 52.4	30.2	7 11.9	27.5	190 27.4	08.9
22	51 15.3	119 00.8	36.2	244 54.0	29.9	22 14.5	27.5	205 29.7	09.0
23	66 17.8	133 59.9	35.7	259 55.5	29.6	37 17.1	27.4	220 32.0	09.1
13 00	81 20.2	148 59.0	S23 35.3	274 57.1	N 8 29.3	52 19.7	N10 27.4	235 34.2	S 8 09.2
01	96 22.7	163 58.1	34.9	289 58.7	29.0	67 22.2	27.4	250 36.5	09.2
02	111 25.2	178 57.3	34.5	305 00.2	28.7	82 24.8	27.3	265 38.7	09.3
03	126 27.6	193 56.4	34.0	320 01.8	28.4	97 27.4	27.3	280 41.0	09.4
04	141 30.1	208 55.5	33.6	335 03.4	28.1	112 30.0	27.3	295 43.2	09.4
05	156 32.5	223 54.7	33.2	350 05.0	27.8	127 32.5	27.3	310 45.5	09.5
06	171 35.0	238 53.8	S23 32.7	5 06.5	N 8 27.5	142 35.1	N10 27.2	325 47.7	S 8 09.6
07	186 37.5	253 52.9	32.3	20 08.1	27.2	157 37.7	27.2	340 50.0	09.6
T 08	201 39.9	268 52.0	31.9	35 09.7	26.9	172 40.3	27.2	355 52.2	09.7
U 09	216 42.4	283 51.2	31.5	50 11.3	26.6	187 42.8	27.2	10 54.5	09.8
E 10	231 44.9	298 50.3	31.0	65 12.8	26.3	202 45.4	27.1	25 56.8	09.9
S 11	246 47.3	313 49.4	30.6	80 14.4	26.0	217 48.0	27.1	40 59.0	09.9
D 12	261 49.8	328 48.5	S23 30.1	95 16.0	N 8 25.7	232 50.5	N10 27.1	56 01.3	S 8 10.0
A 13	276 52.3	343 47.7	29.7	110 17.6	25.3	247 53.1	27.1	71 03.5	10.1
Y 14	291 54.7	358 46.8	29.3	125 19.1	25.0	262 55.7	27.0	86 05.8	10.1
15	306 57.2	13 45.9	28.8	140 20.7	24.7	277 58.2	27.0	101 08.0	10.2
16	321 59.6	28 45.1	28.4	155 22.3	24.4	293 00.8	27.0	116 10.3	10.3
17	337 02.1	43 44.2	27.9	170 23.9	24.1	308 03.4	27.0	131 12.5	10.4
18	352 04.6	58 43.3	S23 27.5	185 25.5	N 8 23.8	323 06.0	N10 26.9	146 14.8	S 8 10.4
19	7 07.0	73 42.5	27.0	200 27.1	23.5	338 08.5	26.9	161 17.1	10.5
20	22 09.5	88 41.6	26.6	215 28.6	23.2	353 11.1	26.9	176 19.3	10.6
21	37 12.0	103 40.7	26.2	230 30.2	22.9	8 13.7	26.9	191 21.6	10.6
22	52 14.4	118 39.9	25.7	245 31.8	22.6	23 16.2	26.8	206 23.8	10.7
23	67 16.9	133 39.0	25.3	260 33.4	22.3	38 18.8	26.8	221 26.1	10.8
14 00	82 19.4	148 38.1	S23 24.8	275 35.0	N 8 22.0	53 21.4	N10 26.8	236 28.3	S 8 10.8
01	97 21.8	163 37.3	24.4	290 36.6	21.7	68 23.9	26.8	251 30.6	10.9
02	112 24.3	178 36.4	23.9	305 38.1	21.4	83 26.5	26.7	266 32.9	11.0
03	127 26.8	193 35.5	23.4	320 39.7	21.1	98 29.1	26.7	281 35.1	11.1
04	142 29.2	208 34.7	23.0	335 41.3	20.8	113 31.6	26.7	296 37.4	11.1
05	157 31.7	223 33.8	22.5	350 42.9	20.5	128 34.2	26.7	311 39.6	11.2
06	172 34.1	238 33.0	S23 22.1	5 44.5	N 8 20.2	143 36.8	N10 26.6	326 41.9	S 8 11.3
W 07	187 36.6	253 32.1	21.6	20 46.1	19.9	158 39.3	26.6	341 44.1	11.3
E 08	202 39.1	268 31.2	21.1	35 47.7	19.6	173 41.9	26.6	356 46.4	11.4
D 09	217 41.5	283 30.4	20.7	50 49.3	19.3	188 44.5	26.6	11 48.7	11.5
N 10	232 44.0	298 29.5	20.2	65 50.8	19.0	203 47.0	26.5	26 50.9	11.5
E 11	247 46.5	313 28.6	19.8	80 52.4	18.7	218 49.6	26.5	41 53.2	11.6
S 12	262 48.9	328 27.8	S23 19.3	95 54.0	N 8 18.4	233 52.1	N10 26.5	56 55.4	S 8 11.7
D 13	277 51.4	343 26.9	18.8	110 55.6	18.1	248 54.7	26.5	71 57.7	11.8
A 14	292 53.9	358 26.1	18.4	125 57.2	17.8	263 57.3	26.5	86 59.9	11.8
Y 15	307 56.3	13 25.2	17.9	140 58.8	17.5	278 59.8	26.4	102 02.2	11.9
16	322 58.8	28 24.3	17.4	156 00.4	17.2	294 02.4	26.4	117 04.5	12.0
17	338 01.3	43 23.5	16.9	171 02.0	16.9	309 05.0	26.4	132 06.7	12.0
18	353 03.7	58 22.6	S23 16.5	186 03.6	N 8 16.6	324 07.5	N10 26.4	147 09.0	S 8 12.1
19	8 06.2	73 21.8	16.0	201 05.2	16.3	339 10.1	26.3	162 11.2	12.2
20	23 08.6	88 20.9	15.5	216 06.8	16.0	354 12.6	26.3	177 13.5	12.2
21	38 11.1	103 20.1	15.0	231 08.4	15.7	9 15.2	26.3	192 15.8	12.3
22	53 13.6	118 19.2	14.6	246 10.0	15.4	24 17.8	26.3	207 18.0	12.4
23	68 16.0	133 18.4	14.1	261 11.6	15.2	39 20.3	26.3	222 20.3	12.4
Mer. Pass.	h m 18 31.6	v −0.9	d 0.4	v 1.6	d 0.3	v 2.6	d 0.0	v 2.3	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.5
Achernar	335 27.2	S57 10.7
Acrux	173 10.7	S63 09.7
Adhara	255 13.0	S28 59.3
Aldebaran	290 50.3	N16 32.0
Alioth	166 21.8	N55 53.4
Alkaid	153 00.0	N49 15.0
Al Na'ir	27 45.2	S46 54.3
Alnilam	275 47.1	S 1 11.7
Alphard	217 57.0	S 8 42.7
Alphecca	126 12.2	N26 40.4
Alpheratz	357 44.5	N29 09.7
Altair	62 09.6	N 8 54.2
Ankaa	353 16.6	S42 14.6
Antares	112 27.9	S26 27.4
Arcturus	145 56.9	N19 07.1
Atria	107 31.3	S69 02.8
Avior	234 18.0	S59 32.8
Bellatrix	278 32.8	N 6 21.6
Betelgeuse	271 02.1	N 7 24.5
Canopus	263 56.1	S52 42.1
Capella	280 35.5	N46 00.5
Deneb	49 32.5	N45 19.7
Denebola	182 34.8	N14 30.1
Diphda	348 56.8	S17 55.3
Dubhe	193 52.9	N61 40.8
Elnath	278 13.6	N28 37.0
Eltanin	90 47.2	N51 29.4
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.2	S29 33.6
Gacrux	172 02.3	S57 10.6
Gienah	175 53.5	S17 36.5
Hadar	148 49.9	S60 25.6
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 20.9	N74 06.1
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.2
Menkent	148 09.1	S36 25.6
Miaplacidus	221 39.4	S69 45.8
Mirfak	308 41.4	N49 54.3
Nunki	76 00.0	S26 16.8
Peacock	53 21.3	S56 41.8
Pollux	243 28.7	N27 59.6
Procyon	245 00.5	N 5 11.5
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.5	N11 54.3
Rigel	281 12.7	S 8 11.3
Rigil Kent.	139 53.7	S60 52.8
Sabik	102 14.1	S15 44.3
Schedar	349 41.6	N56 36.5
Shaula	96 23.8	S37 06.6
Sirius	258 34.3	S16 44.0
Spica	158 32.5	S11 13.4
Suhail	222 53.0	S43 28.8
Vega	80 40.1	N38 47.9
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	67 38.8	14 05
Mars	193 36.9	5 40
Jupiter	330 59.4	20 27
Saturn	154 14.0	8 16

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
12 00	181 40.2	S23 01.7	344 24.5	9.7	N21 24.1	4.1	55.8
01	196 39.9	01.9	358 53.2	9.8	21 20.0	4.1	55.8
02	211 39.6	02.1	13 22.0	9.8	21 15.9	4.3	55.8
03	226 39.3	02.3	27 50.8	9.8	21 11.6	4.5	55.9
04	241 39.0	02.5	42 19.6	9.8	21 07.1	4.5	55.9
05	256 38.7	02.7	56 48.4	9.8	21 02.6	4.6	55.9
06	271 38.4	S23 02.9	71 17.2	9.8	N20 58.0	4.8	55.9
07	286 38.2	03.1	85 46.0	9.9	20 53.2	4.8	55.9
08	301 37.9	03.3	100 14.9	9.9	20 48.4	5.0	56.0
M 09	316 37.6	03.5	114 43.8	9.8	20 43.4	5.1	56.0
O 10	331 37.3	03.7	129 12.6	9.9	20 38.3	5.2	56.0
N 11	346 37.0	03.9	143 41.5	10.0	20 33.1	5.3	56.0
D 12	1 36.7	S23 04.1	158 10.5	9.9	N20 27.8	5.5	56.0
A 13	16 36.4	04.2	172 39.4	9.9	20 22.3	5.5	56.1
Y 14	31 36.1	04.4	187 08.3	10.0	20 16.8	5.6	56.1
15	46 35.8	04.6	201 37.3	10.0	20 11.2	5.8	56.1
16	61 35.6	04.8	216 06.3	10.0	20 05.4	5.8	56.1
17	76 35.3	05.0	230 35.3	10.0	19 59.6	6.0	56.1
18	91 35.0	S23 05.2	245 04.3	10.1	N19 53.6	6.1	56.1
19	106 34.7	05.4	259 33.4	10.1	19 47.5	6.2	56.2
20	121 34.4	05.5	274 02.5	10.1	19 41.3	6.3	56.2
21	136 34.1	05.7	288 31.6	10.1	19 35.0	6.4	56.2
22	151 33.8	05.9	303 00.7	10.1	19 28.6	6.5	56.2
23	166 33.5	06.1	317 29.8	10.2	19 22.1	6.6	56.2
13 00	181 33.2	S23 06.3	331 59.0	10.2	N19 15.5	6.7	56.3
01	196 32.9	06.4	346 28.2	10.2	19 08.8	6.8	56.3
02	211 32.6	06.6	0 57.4	10.2	19 02.0	6.9	56.3
03	226 32.3	06.8	15 26.6	10.3	18 55.1	7.0	56.3
04	241 32.1	07.0	29 55.9	10.3	18 48.1	7.2	56.3
05	256 31.8	07.1	44 25.2	10.3	18 40.9	7.2	56.4
06	271 31.5	S23 07.3	58 54.5	10.3	N18 33.7	7.3	56.4
07	286 31.2	07.5	73 23.8	10.4	18 26.4	7.5	56.4
T 08	301 30.9	07.7	87 53.2	10.4	18 18.9	7.5	56.4
U 09	316 30.6	07.8	102 22.6	10.4	18 11.4	7.6	56.4
E 10	331 30.3	08.0	116 52.0	10.5	18 03.8	7.7	56.5
S 11	346 30.0	08.2	131 21.5	10.4	17 56.1	7.9	56.5
D 12	1 29.7	S23 08.4	145 50.9	10.6	N17 48.2	7.9	56.5
A 13	16 29.4	08.5	160 20.5	10.5	17 40.3	8.0	56.5
Y 14	31 29.1	08.7	174 50.0	10.5	17 32.3	8.1	56.5
15	46 28.8	08.9	189 19.5	10.6	17 24.2	8.2	56.6
16	61 28.5	09.0	203 49.1	10.6	17 16.0	8.3	56.6
17	76 28.2	09.2	218 18.7	10.7	17 07.7	8.4	56.6
18	91 28.0	S23 09.4	232 48.4	10.7	N16 59.3	8.5	56.6
19	106 27.7	09.5	247 18.1	10.6	16 50.8	8.6	56.7
20	121 27.4	09.7	261 47.7	10.8	16 42.2	8.6	56.7
21	136 27.1	09.9	276 17.5	10.7	16 33.6	8.8	56.7
22	151 26.8	10.0	290 47.2	10.8	16 24.8	8.8	56.7
23	166 26.5	10.2	305 17.0	10.8	16 16.0	9.0	56.7
14 00	181 26.2	S23 10.3	319 46.8	10.9	N16 07.0	9.0	56.8
01	196 25.9	10.5	334 16.7	10.8	15 58.0	9.1	56.8
02	211 25.6	10.7	348 46.5	10.9	15 48.9	9.2	56.8
03	226 25.3	10.8	3 16.4	11.0	15 39.7	9.3	56.8
04	241 25.0	11.0	17 46.4	10.9	15 30.4	9.4	56.8
05	256 24.7	11.1	32 16.3	11.0	15 21.0	9.5	56.9
06	271 24.4	S23 11.3	46 46.3	11.0	N15 11.5	9.5	56.9
W 07	286 24.1	11.4	61 16.3	11.0	15 02.0	9.6	56.9
E 08	301 23.8	11.6	75 46.3	11.1	14 52.4	9.7	56.9
D 09	316 23.5	11.7	90 16.4	11.1	14 42.7	9.8	56.9
N 10	331 23.2	11.9	104 46.5	11.1	14 32.9	9.9	57.0
E 11	346 22.9	12.1	119 16.6	11.1	14 23.0	9.9	57.0
S 12	1 22.6	S23 12.2	133 46.7	11.2	N14 13.1	10.1	57.0
D 13	16 22.3	12.4	148 16.9	11.2	14 03.0	10.1	57.0
A 14	31 22.0	12.5	162 47.1	11.2	13 52.9	10.2	57.0
Y 15	46 21.7	12.7	177 17.3	11.3	13 42.7	10.2	57.1
16	61 21.4	12.8	191 47.6	11.3	13 32.5	10.3	57.1
17	76 21.1	12.9	206 17.9	11.3	13 22.2	10.5	57.1
18	91 20.8	S23 13.1	220 48.2	11.3	N13 11.7	10.4	57.1
19	106 20.6	13.2	235 18.5	11.3	13 01.3	10.6	57.1
20	121 20.3	13.4	249 48.8	11.4	12 50.7	10.6	57.2
21	136 20.0	13.5	264 19.2	11.4	12 40.1	10.7	57.2
22	151 19.7	13.7	278 49.6	11.4	12 29.4	10.8	57.2
23	166 19.4	13.8	293 20.0	11.5	N12 18.6	10.8	57.2
	SD 16.3	d 0.2	SD 15.3		15.4		15.5

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 12	Moonrise 13	Moonrise 14	Moonrise 15
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 17	10 39	▬	▭	15 34	18 16	20 25
N 70	07 57	09 43	▬	▭	16 36	18 41	20 38
68	07 42	09 10	▬	15 16	17 11	19 01	20 48
66	07 29	08 45	10 22	15 56	17 36	19 16	20 56
64	07 18	08 26	09 42	16 24	17 55	19 29	21 03
62	07 09	08 10	09 15	16 46	18 10	19 39	21 09
60	07 01	07 57	08 54	17 03	18 23	19 48	21 15
N 58	06 53	07 46	08 37	17 17	18 35	19 56	21 19
56	06 47	07 36	08 23	17 29	18 44	20 03	21 23
54	06 41	07 27	08 10	17 40	18 53	20 09	21 27
52	06 35	07 19	08 00	17 50	19 00	20 14	21 30
50	06 30	07 12	07 50	17 58	19 07	20 19	21 33
45	06 19	06 56	07 29	18 16	19 22	20 30	21 40
N 40	06 08	06 42	07 13	18 31	19 34	20 39	21 45
35	05 59	06 31	06 59	18 43	19 44	20 47	21 50
30	05 51	06 20	06 47	18 54	19 53	20 53	21 54
20	05 34	06 02	06 26	19 13	20 09	21 05	22 01
N 10	05 18	05 45	06 07	19 29	20 22	21 15	22 07
0	05 02	05 28	05 50	19 44	20 34	21 24	22 13
S 10	04 43	05 10	05 33	19 59	20 47	21 33	22 18
20	04 21	04 50	05 14	20 15	21 00	21 43	22 24
30	03 52	04 25	04 52	20 33	21 15	21 55	22 31
35	03 33	04 10	04 40	20 44	21 24	22 01	22 35
40	03 11	03 52	04 25	20 56	21 34	22 08	22 40
45	02 41	03 30	04 07	21 10	21 46	22 17	22 45
S 50	01 56	03 01	03 45	21 28	22 00	22 27	22 51
52	01 30	02 46	03 34	21 36	22 06	22 32	22 54
54	00 48	02 29	03 22	21 45	22 14	22 37	22 57
56	////	02 07	03 08	21 55	22 22	22 43	23 01
58	////	01 39	02 52	22 07	22 31	22 49	23 05
S 60	////	00 53	02 32	22 21	22 41	22 57	23 09

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 12	Moonset 13	Moonset 14	Moonset 15
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 09	15 31	▭	13 24	12 27	12 00
N 70	▬	14 05	15 50	▭	12 21	11 59	11 45
68	▬	14 38	16 06	11 54	11 45	11 39	11 33
66	13 26	15 02	16 19	11 13	11 19	11 22	11 23
64	14 05	15 22	16 29	10 44	10 59	11 08	11 14
62	14 33	15 37	16 39	10 22	10 43	10 57	11 07
60	14 54	15 51	16 47	10 05	10 29	10 47	11 01
N 58	15 11	16 02	16 54	09 50	10 18	10 38	10 55
56	15 25	16 12	17 01	09 37	10 07	10 31	10 50
54	15 37	16 21	17 07	09 26	09 58	10 24	10 46
52	15 48	16 29	17 13	09 16	09 50	10 18	10 42
50	15 58	16 36	17 18	09 08	09 43	10 12	10 38
45	16 18	16 52	17 29	08 49	09 27	10 00	10 30
N 40	16 35	17 06	17 40	08 34	09 14	09 50	10 23
35	16 49	17 17	17 49	08 21	09 03	09 42	10 17
30	17 01	17 28	17 57	08 09	08 53	09 34	10 12
20	17 22	17 46	18 14	07 50	08 37	09 21	10 03
N 10	17 41	18 03	18 30	07 33	08 22	09 09	09 55
0	17 58	18 20	18 46	07 17	08 08	08 58	09 47
S 10	18 15	18 38	19 05	07 01	07 54	08 47	09 40
20	18 34	18 58	19 28	06 44	07 39	08 36	09 32
30	18 56	19 23	19 56	06 24	07 22	08 22	09 22
35	19 09	19 38	20 15	06 12	07 12	08 14	09 17
40	19 23	19 56	20 38	05 59	07 01	08 05	09 10
45	19 41	20 18	21 08	05 43	06 47	07 54	09 03
S 50	20 03	20 48	21 52	05 24	06 31	07 41	08 54
52	20 14	21 03	22 19	05 15	06 23	07 35	08 50
54	20 26	21 20	23 02	05 04	06 14	07 29	08 46
56	20 40	21 42	////	04 52	06 04	07 21	08 41
58	20 57	22 11	////	04 39	05 53	07 13	08 35
S 60	21 17	22 57	////	04 23	05 40	07 03	08 29

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
12	06 41	06 27	11 54	01 05	13 30	17	96
13	06 13	05 59	11 54	01 56	14 21	18	92
14	05 45	05 31	11 54	02 46	15 11	19	85

UT	ARIES	VENUS −3.9		MARS +0.5		JUPITER −2.7		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
15 00	83 18.5	148 17.5	S23 13.6	276 13.2	N 8 14.9	54 22.9	N10 26.2	237 22.5	S 8 12.5
01	98 21.0	163 16.6	13.1	291 14.8	14.6	69 25.4	26.2	252 24.8	12.6
02	113 23.4	178 15.8	12.6	306 16.4	14.3	84 28.0	26.2	267 27.1	12.7
03	128 25.9	193 14.9	. . 12.2	321 18.0	. . 14.0	99 30.6	. . 26.2	282 29.3	. . 12.7
04	143 28.4	208 14.1	11.7	336 19.6	13.7	114 33.1	26.2	297 31.6	12.8
05	158 30.8	223 13.2	11.2	351 21.2	13.4	129 35.7	26.1	312 33.8	12.9
06	173 33.3	238 12.4	S23 10.7	6 22.8	N 8 13.1	144 38.2	N10 26.1	327 36.1	S 8 12.9
07	188 35.8	253 11.5	10.2	21 24.4	12.8	159 40.8	26.1	342 38.4	13.0
T 08	203 38.2	268 10.7	09.7	36 26.0	12.5	174 43.3	26.1	357 40.6	13.1
H 09	218 40.7	283 09.8	. . 09.2	51 27.6	. . 12.2	189 45.9	. . 26.0	12 42.9	. . 13.1
U 10	233 43.1	298 09.0	08.7	66 29.2	11.9	204 48.4	26.0	27 45.1	13.2
R 11	248 45.6	313 08.1	08.2	81 30.8	11.6	219 51.0	26.0	42 47.4	13.3
S 12	263 48.1	328 07.3	S23 07.7	96 32.4	N 8 11.3	234 53.6	N10 26.0	57 49.7	S 8 13.3
D 13	278 50.5	343 06.4	07.2	111 34.0	11.0	249 56.1	26.0	72 51.9	13.4
A 14	293 53.0	358 05.6	06.8	126 35.6	10.7	264 58.7	26.0	87 54.2	13.5
Y 15	308 55.5	13 04.7	. . 06.3	141 37.2	. . 10.4	280 01.2	. . 25.9	102 56.4	. . 13.5
16	323 57.9	28 03.9	05.8	156 38.8	10.2	295 03.8	25.9	117 58.7	13.6
17	339 00.4	43 03.0	05.3	171 40.4	09.9	310 06.3	25.9	133 01.0	13.7
18	354 02.9	58 02.2	S23 04.8	186 42.0	N 8 09.6	325 08.9	N10 25.9	148 03.2	S 8 13.7
19	9 05.3	73 01.3	04.2	201 43.6	09.3	340 11.4	25.9	163 05.5	13.8
20	24 07.8	88 00.5	03.7	216 45.2	09.0	355 14.0	25.8	178 07.7	13.9
21	39 10.2	102 59.6	. . 03.2	231 46.9	. . 08.7	10 16.5	. . 25.8	193 10.0	. . 14.0
22	54 12.7	117 58.8	02.7	246 48.5	08.4	25 19.1	25.8	208 12.3	14.0
23	69 15.2	132 58.0	02.2	261 50.1	08.1	40 21.6	25.8	223 14.5	14.1
16 00	84 17.6	147 57.1	S23 01.7	276 51.7	N 8 07.8	55 24.2	N10 25.8	238 16.8	S 8 14.2
01	99 20.1	162 56.3	01.2	291 53.3	07.5	70 26.7	25.7	253 19.1	14.2
02	114 22.6	177 55.4	00.7	306 54.9	07.2	85 29.3	25.7	268 21.3	14.3
03	129 25.0	192 54.6	23 00.2	321 56.5	. . 07.0	100 31.8	. . 25.7	283 23.6	. . 14.4
04	144 27.5	207 53.7	22 59.7	336 58.1	06.7	115 34.4	25.7	298 25.8	14.4
05	159 30.0	222 52.9	59.2	351 59.8	06.4	130 36.9	25.7	313 28.1	14.5
06	174 32.4	237 52.1	S22 58.6	7 01.4	N 8 06.1	145 39.5	N10 25.7	328 30.4	S 8 14.6
07	189 34.9	252 51.2	58.1	22 03.0	05.8	160 42.0	25.6	343 32.6	14.6
08	204 37.4	267 50.4	57.6	37 04.6	05.5	175 44.6	25.6	358 34.9	14.7
F 09	219 39.8	282 49.5	. . 57.1	52 06.2	. . 05.2	190 47.1	. . 25.6	13 37.2	. . 14.8
R 10	234 42.3	297 48.7	56.6	67 07.8	04.9	205 49.7	25.6	28 39.4	14.8
I 11	249 44.7	312 47.9	56.0	82 09.5	04.7	220 52.2	25.6	43 41.7	14.9
D 12	264 47.2	327 47.0	S22 55.5	97 11.1	N 8 04.4	235 54.8	N10 25.6	58 43.9	S 8 15.0
A 13	279 49.7	342 46.2	55.0	112 12.7	04.1	250 57.3	25.5	73 46.2	15.0
Y 14	294 52.1	357 45.4	54.5	127 14.3	03.8	265 59.9	25.5	88 48.5	15.1
15	309 54.6	12 44.5	. . 53.9	142 15.9	. . 03.5	281 02.4	. . 25.5	103 50.7	. . 15.2
16	324 57.1	27 43.7	53.4	157 17.6	03.2	296 05.0	25.5	118 53.0	15.2
17	339 59.5	42 42.8	52.9	172 19.2	02.9	311 07.5	25.5	133 55.3	15.3
18	355 02.0	57 42.0	S22 52.4	187 20.8	N 8 02.6	326 10.1	N10 25.5	148 57.5	S 8 15.4
19	10 04.5	72 41.2	51.8	202 22.4	02.4	341 12.6	25.4	163 59.8	15.4
20	25 06.9	87 40.3	51.3	217 24.0	02.1	356 15.1	25.4	179 02.1	15.5
21	40 09.4	102 39.5	. . 50.8	232 25.7	. . 01.8	11 17.7	. . 25.4	194 04.3	. . 15.6
22	55 11.9	117 38.7	50.2	247 27.3	01.5	26 20.2	25.4	209 06.6	15.6
23	70 14.3	132 37.8	49.7	262 28.9	01.2	41 22.8	25.4	224 08.9	15.7
17 00	85 16.8	147 37.0	S22 49.1	277 30.5	N 8 00.9	56 25.3	N10 25.4	239 11.1	S 8 15.8
01	100 19.2	162 36.2	48.6	292 32.2	00.7	71 27.9	25.3	254 13.4	15.8
02	115 21.7	177 35.3	48.1	307 33.8	00.4	86 30.4	25.3	269 15.7	15.9
03	130 24.2	192 34.5	. . 47.5	322 35.4	8 00.1	101 32.9	. . 25.3	284 17.9	. . 16.0
04	145 26.6	207 33.7	47.0	337 37.1	7 59.8	116 35.5	25.3	299 20.2	16.0
05	160 29.1	222 32.8	46.4	352 38.7	59.5	131 38.0	25.3	314 22.4	16.1
06	175 31.6	237 32.0	S22 45.9	7 40.3	N 7 59.2	146 40.6	N10 25.3	329 24.7	S 8 16.2
07	190 34.0	252 31.2	45.4	22 41.9	59.0	161 43.1	25.3	344 27.0	16.2
S 08	205 36.5	267 30.4	44.8	37 43.6	58.7	176 45.6	25.2	359 29.2	16.3
A 09	220 39.0	282 29.5	. . 44.3	52 45.2	. . 58.4	191 48.2	. . 25.2	14 31.5	. . 16.4
T 10	235 41.4	297 28.7	43.7	67 46.8	58.1	206 50.7	25.2	29 33.8	16.4
U 11	250 43.9	312 27.9	43.2	82 48.5	57.8	221 53.3	25.2	44 36.0	16.5
R 12	265 46.3	327 27.1	S22 42.6	97 50.1	N 7 57.5	236 55.8	N10 25.2	59 38.3	S 8 16.6
D 13	280 48.8	342 26.2	42.1	112 51.7	57.3	251 58.3	25.2	74 40.6	16.6
A 14	295 51.3	357 25.4	41.5	127 53.4	57.0	267 00.9	25.2	89 42.8	16.7
Y 15	310 53.7	12 24.6	. . 40.9	142 55.0	. . 56.7	282 03.4	. . 25.1	104 45.1	. . 16.8
16	325 56.2	27 23.7	40.4	157 56.6	56.4	297 06.0	25.1	119 47.4	16.8
17	340 58.7	42 22.9	39.8	172 58.3	56.1	312 08.5	25.1	134 49.6	16.9
18	356 01.1	57 22.1	S22 39.3	187 59.9	N 7 55.9	327 11.0	N10 25.1	149 51.9	S 8 17.0
19	11 03.6	72 21.3	38.7	203 01.6	55.6	342 13.6	25.1	164 54.2	17.0
20	26 06.1	87 20.5	38.2	218 03.2	55.3	357 16.1	25.1	179 56.4	17.1
21	41 08.5	102 19.6	. . 37.6	233 04.8	. . 55.0	12 18.6	. . 25.1	194 58.7	. . 17.1
22	56 11.0	117 18.8	37.0	248 06.5	54.8	27 21.2	25.1	210 01.0	17.2
23	71 13.5	132 18.0	36.5	263 08.1	54.5	42 23.7	25.0	225 03.2	17.3
	h m								
Mer. Pass.	18 19.8	v −0.8	d 0.5	v 1.6	d 0.3	v 2.5	d 0.0	v 2.3	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.5
Achernar	335 27.2	S57 10.7
Acrux	173 10.7	S63 09.7
Adhara	255 13.0	S28 59.3
Aldebaran	290 50.2	N16 32.0
Alioth	166 21.8	N55 53.3
Alkaid	153 00.0	N49 14.9
Al Na'ir	27 45.2	S46 54.3
Alnilam	275 47.1	S 1 11.7
Alphard	217 56.9	S 8 42.7
Alphecca	126 12.2	N26 40.4
Alpheratz	357 44.5	N29 09.7
Altair	62 09.6	N 8 54.2
Ankaa	353 16.6	S42 14.6
Antares	112 27.9	S26 27.4
Arcturus	145 56.9	N19 07.1
Atria	107 31.3	S69 02.8
Avior	234 18.0	S59 32.8
Bellatrix	278 32.8	N 6 21.6
Betelgeuse	271 02.1	N 7 24.5
Canopus	263 56.1	S52 42.2
Capella	280 35.5	N46 00.5
Deneb	49 32.5	N45 19.7
Denebola	182 34.7	N14 30.1
Diphda	348 56.8	S17 55.3
Dubhe	193 52.8	N61 40.8
Elnath	278 13.6	N28 37.0
Eltanin	90 47.2	N51 29.3
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.2	S29 33.6
Gacrux	172 02.3	S57 10.6
Gienah	175 53.4	S17 36.5
Hadar	148 49.8	S60 25.6
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 20.8	N74 06.1
Markab	13 39.4	N15 16.4
Menkar	314 15.9	N 4 08.2
Menkent	148 09.1	S36 25.6
Miaplacidus	221 39.3	S69 45.8
Mirfak	308 41.4	N49 54.4
Nunki	76 00.0	S26 16.8
Peacock	53 21.3	S56 41.8
Pollux	243 28.7	N27 59.6
Procyon	245 00.5	N 5 11.5
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.5	N11 54.3
Rigel	281 12.7	S 8 11.3
Rigil Kent.	139 53.7	S60 52.8
Sabik	102 14.1	S15 44.3
Schedar	349 41.6	N56 36.5
Shaula	96 23.8	S37 06.6
Sirius	258 34.3	S16 44.0
Spica	158 32.5	S11 13.4
Suhail	222 52.9	S43 28.8
Vega	80 40.1	N38 47.9
Zuben'ubi	137 06.9	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	63 39.5	14 09
Mars	192 34.0	5 32
Jupiter	331 06.6	20 15
Saturn	153 59.2	8 06

UT	SUN			MOON						
	GHA		Dec	GHA		v	Dec		d	HP
d h	°	′	° ′	°	′	′	°	′	′	′
15 00	181	19.1	S23 14.0	307	50.5	11.4	N12	07.8	10.9	57.3
01	196	18.8	14.1	322	20.9	11.5	11	56.9	11.0	57.3
02	211	18.5	14.2	336	51.4	11.5	11	45.9	11.0	57.3
03	226	18.2	14.4	351	21.9	11.6	11	34.9	11.1	57.3
04	241	17.9	14.5	5	52.5	11.5	11	23.8	11.2	57.3
05	256	17.6	14.6	20	23.0	11.6	11	12.6	11.2	57.4
06	271	17.3	S23 14.8	34	53.6	11.6	N11	01.4	11.3	57.4
07	286	17.0	14.9	49	24.2	11.6	10	50.1	11.4	57.4
08	301	16.7	15.1	63	54.8	11.6	10	38.7	11.4	57.4
09	316	16.4	15.2	78	25.4	11.6	10	27.3	11.5	57.4
10	331	16.1	15.3	92	56.0	11.7	10	15.8	11.5	57.5
11	346	15.8	15.5	107	26.7	11.7	10	04.3	11.6	57.5
12	1	15.5	S23 15.6	121	57.4	11.7	N 9	52.7	11.7	57.5
13	16	15.2	15.7	136	28.1	11.7	9	41.0	11.7	57.5
14	31	14.9	15.8	150	58.8	11.7	9	29.3	11.8	57.6
15	46	14.6	16.0	165	29.5	11.7	9	17.5	11.8	57.6
16	61	14.3	16.1	180	00.2	11.8	9	05.7	11.9	57.6
17	76	14.0	16.2	194	31.0	11.8	8	53.8	11.9	57.6
18	91	13.7	S23 16.4	209	01.8	11.7	N 8	41.9	12.0	57.6
19	106	13.4	16.5	223	32.5	11.8	8	29.9	12.0	57.7
20	121	13.1	16.6	238	03.3	11.8	8	17.9	12.1	57.7
21	136	12.8	16.7	252	34.1	11.8	8	05.8	12.1	57.7
22	151	12.5	16.9	267	04.9	11.9	7	53.7	12.2	57.7
23	166	12.2	17.0	281	35.8	11.8	7	41.5	12.2	57.7
16 00	181	11.9	S23 17.1	296	06.6	11.8	N 7	29.3	12.3	57.8
01	196	11.6	17.2	310	37.4	11.9	7	17.0	12.3	57.8
02	211	11.3	17.3	325	08.3	11.8	7	04.7	12.4	57.8
03	226	11.0	17.5	339	39.1	11.9	6	52.3	12.4	57.8
04	241	10.7	17.6	354	10.0	11.8	6	39.9	12.4	57.9
05	256	10.4	17.7	8	40.8	11.9	6	27.5	12.5	57.9
06	271	10.1	S23 17.8	23	11.7	11.9	N 6	15.0	12.5	57.9
07	286	09.8	17.9	37	42.6	11.8	6	02.5	12.6	57.9
08	301	09.5	18.1	52	13.4	11.9	5	49.9	12.6	57.9
09	316	09.2	18.2	66	44.3	11.9	5	37.3	12.6	58.0
10	331	08.8	18.3	81	15.2	11.8	5	24.7	12.7	58.0
11	346	08.5	18.4	95	46.0	11.9	5	12.0	12.7	58.0
12	1	08.2	S23 18.5	110	16.9	11.9	N 4	59.3	12.8	58.0
13	16	07.9	18.6	124	47.8	11.8	4	46.5	12.7	58.1
14	31	07.6	18.7	139	18.6	11.9	4	33.8	12.8	58.1
15	46	07.3	18.8	153	49.5	11.9	4	21.0	12.9	58.1
16	61	07.0	18.9	168	20.4	11.8	4	08.1	12.9	58.1
17	76	06.7	19.1	182	51.2	11.9	3	55.2	12.9	58.1
18	91	06.4	S23 19.2	197	22.1	11.8	N 3	42.3	12.9	58.2
19	106	06.1	19.3	211	52.9	11.8	3	29.4	12.9	58.2
20	121	05.8	19.4	226	23.7	11.9	3	16.5	13.0	58.2
21	136	05.5	19.5	240	54.6	11.8	3	03.5	13.0	58.2
22	151	05.2	19.6	255	25.4	11.8	2	50.5	13.0	58.2
23	166	04.9	19.7	269	56.2	11.8	2	37.5	13.1	58.3
17 00	181	04.6	S23 19.8	284	27.0	11.8	N 2	24.4	13.1	58.3
01	196	04.3	19.9	298	57.8	11.7	2	11.3	13.1	58.3
02	211	04.0	20.0	313	28.5	11.8	1	58.2	13.1	58.3
03	226	03.7	20.1	327	59.3	11.7	1	45.1	13.1	58.4
04	241	03.4	20.2	342	30.0	11.7	1	32.0	13.1	58.4
05	256	03.1	20.3	357	00.7	11.7	1	18.9	13.2	58.4
06	271	02.8	S23 20.4	11	31.4	11.7	N 1	05.7	13.2	58.4
07	286	02.5	20.5	26	02.1	11.7	0	52.5	13.2	58.4
08	301	02.2	20.6	40	32.8	11.6	0	39.3	13.2	58.5
09	316	01.9	20.7	55	03.4	11.7	0	26.1	13.2	58.5
10	331	01.6	20.8	69	34.1	11.6	N 0	12.9	13.2	58.5
11	346	01.3	20.9	84	04.7	11.6	S 0	00.3	13.3	58.5
12	1	01.0	S23 21.0	98	35.3	11.5	S 0	13.6	13.2	58.6
13	16	00.6	21.1	113	05.8	11.6	0	26.8	13.3	58.6
14	31	00.3	21.1	127	36.4	11.5	0	40.1	13.2	58.6
15	46	00.0	21.2	142	06.9	11.4	0	53.3	13.3	58.6
16	60	59.7	21.3	156	37.3	11.5	1	06.6	13.3	58.6
17	75	59.4	21.4	171	07.8	11.4	1	19.9	13.2	58.7
18	90	59.1	S23 21.5	185	38.2	11.4	S 1	33.1	13.3	58.7
19	105	58.8	21.6	200	08.6	11.4	1	46.4	13.3	58.7
20	120	58.5	21.7	214	39.0	11.3	1	59.7	13.2	58.7
21	135	58.2	21.8	229	09.3	11.3	2	12.9	13.3	58.7
22	150	57.9	21.8	243	39.6	11.3	2	26.2	13.3	58.8
23	165	57.6	21.9	258	09.9	11.2	S 2	39.5	13.2	58.8
	SD	16.3	d 0.1	SD		15.7		15.8		16.0

THURSDAY

FRIDAY

SATURDAY

Lat.	Twilight		Sunrise	Moonrise			
	Naut.	Civil		15	16	17	18
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 21	10 48		20 25	22 27	24 29	00 29
N 70	08 01	09 49		20 38	22 31	24 25	00 25
68	07 45	09 14		20 48	22 34	24 21	00 21
66	07 32	08 49	10 28	20 56	22 36	24 18	00 18
64	07 21	08 30	09 47	21 03	22 39	24 15	00 15
62	07 12	08 14	09 19	21 09	22 41	24 13	00 13
60	07 04	08 00	08 58	21 15	22 42	24 11	00 11
N 58	06 56	07 49	08 40	21 19	22 44	24 09	00 09
56	06 49	07 38	08 26	21 23	22 45	24 08	00 08
54	06 43	07 29	08 13	21 27	22 46	24 07	00 07
52	06 38	07 21	08 02	21 30	22 47	24 05	00 05
50	06 32	07 14	07 52	21 33	22 48	24 04	00 04
45	06 21	06 58	07 32	21 40	22 50	24 02	00 02
N 40	06 10	06 44	07 15	21 45	22 52	24 00	00 00
35	06 01	06 33	07 01	21 50	22 53	23 58	25 04
30	05 52	06 22	06 49	21 54	22 55	23 57	25 00
20	05 36	06 03	06 27	22 01	22 57	23 54	24 52
N 10	05 20	05 46	06 09	22 07	22 59	23 52	24 46
0	05 03	05 29	05 52	22 13	23 01	23 50	24 40
S 10	04 44	05 11	05 34	22 18	23 03	23 48	24 34
20	04 22	04 51	05 15	22 24	23 05	23 45	24 27
30	03 53	04 26	04 53	22 31	23 07	23 43	24 20
35	03 34	04 11	04 40	22 35	23 08	23 42	24 16
40	03 11	03 53	04 25	22 40	23 10	23 40	24 11
45	02 41	03 30	04 08	22 45	23 12	23 38	24 06
S 50	01 56	03 01	03 45	22 51	23 14	23 36	24 00
52	01 28	02 46	03 34	22 54	23 15	23 35	23 57
54	00 44	02 28	03 22	22 57	23 16	23 34	23 54
56	////	02 06	03 08	23 01	23 17	23 33	23 50
58	////	01 37	02 51	23 05	23 18	23 32	23 46
S 60	////	00 49	02 31	23 09	23 20	23 30	23 42

Lat.	Sunset	Twilight		Moonset			
		Civil	Naut.	15	16	17	18
°	h m	h m	h m	h m	h m	h m	h m
N 72		13 02	15 30	12 00	11 40	11 21	11 03
N 70		14 02	15 50	11 45	11 33	11 22	11 10
68		14 37	16 05	11 33	11 27	11 22	11 17
66	13 22	15 02	16 18	11 23	11 23	11 22	11 22
64	14 04	15 21	16 29	11 14	11 19	11 22	11 26
62	14 32	15 37	16 39	11 07	11 15	11 23	11 30
60	14 53	15 50	16 47	11 01	11 12	11 23	11 33
N 58	15 10	16 02	16 55	10 55	11 09	11 23	11 36
56	15 25	16 12	17 01	10 50	11 07	11 23	11 39
54	15 38	16 21	17 08	10 46	11 05	11 23	11 42
52	15 49	16 29	17 13	10 42	11 03	11 23	11 44
50	15 58	16 37	17 18	10 38	11 01	11 23	11 46
45	16 19	16 53	17 30	10 30	10 57	11 23	11 50
N 40	16 36	17 06	17 40	10 23	10 54	11 23	11 54
35	16 50	17 18	17 50	10 17	10 51	11 23	11 57
30	17 02	17 29	17 58	10 12	10 48	11 24	12 00
20	17 23	17 47	18 15	10 03	10 43	11 24	12 05
N 10	17 42	18 05	18 31	09 55	10 39	11 24	12 09
0	17 59	18 22	18 48	09 47	10 36	11 24	12 13
S 10	18 17	18 40	19 07	09 40	10 32	11 24	12 17
20	18 36	19 00	19 29	09 32	10 28	11 24	12 22
30	18 58	19 25	19 58	09 22	10 23	11 24	12 27
35	19 11	19 40	20 17	09 17	10 20	11 24	12 29
40	19 26	19 58	20 40	09 10	10 17	11 24	12 33
45	19 43	20 21	21 10	09 03	10 13	11 24	12 36
S 50	20 06	20 50	21 56	08 54	10 09	11 24	12 41
52	20 17	21 05	22 23	08 50	10 07	11 24	12 43
54	20 29	21 23	23 08	08 46	10 04	11 24	12 45
56	20 43	21 45	////	08 41	10 02	11 24	12 48
58	21 00	22 15	////	08 35	09 59	11 24	12 51
S 60	21 20	23 04	////	08 29	09 56	11 24	12 54

Day	SUN			MOON			
	Eqn. of Time		Mer. Pass.	Mer. Pass.		Age	Phase
	00^h	12^h		Upper	Lower		
d	m s	m s	h m	h m	h m	d	%
15	05 17	05 02	11 55	03 36	16 00	20	77
16	04 48	04 34	11 55	04 24	16 48	21	67
17	04 19	04 04	11 56	05 12	17 37	22	56

UT	ARIES	VENUS −3.9		MARS +0.4		JUPITER −2.7		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
18 00	86 15.9	147 17.2	S22 35.9	278 09.8	N 7 54.2	57 26.2	N10 25.0	240 05.5	S 8 17.3
01	101 18.4	162 16.3	35.3	293 11.4	53.9	72 28.8	25.0	255 07.8	17.4
02	116 20.8	177 15.5	34.8	308 13.0	53.6	87 31.3	25.0	270 10.1	17.5
03	131 23.3	192 14.7	34.2	323 14.7	53.4	102 33.8	25.0	285 12.3	17.5
04	146 25.8	207 13.9	33.6	338 16.3	53.1	117 36.4	25.0	300 14.6	17.6
05	161 28.2	222 13.1	33.1	353 18.0	52.8	132 38.9	25.0	315 16.9	17.7
06	176 30.7	237 12.3	S22 32.5	8 19.6	N 7 52.5	147 41.4	N10 25.0	330 19.1	S 8 17.7
07	191 33.2	252 11.4	31.9	23 21.3	52.3	162 44.0	24.9	345 21.4	17.8
08	206 35.6	267 10.6	31.3	38 22.9	52.0	177 46.5	24.9	0 23.7	17.9
S 09	221 38.1	282 09.8	30.8	53 24.5	51.7	192 49.0	24.9	15 25.9	17.9
U 10	236 40.6	297 09.0	30.2	68 26.2	51.4	207 51.6	24.9	30 28.2	18.0
N 11	251 43.0	312 08.2	29.6	83 27.8	51.2	222 54.1	24.9	45 30.5	18.1
D 12	266 45.5	327 07.4	S22 29.0	98 29.5	N 7 50.9	237 56.6	N10 24.9	60 32.7	S 8 18.1
A 13	281 48.0	342 06.5	28.5	113 31.1	50.6	252 59.2	24.9	75 35.0	18.2
Y 14	296 50.4	357 05.7	27.9	128 32.8	50.3	268 01.7	24.9	90 37.3	18.3
15	311 52.9	12 04.9	27.3	143 34.4	50.1	283 04.2	24.9	105 39.5	18.3
16	326 55.3	27 04.1	26.7	158 36.1	49.8	298 06.8	24.9	120 41.8	18.4
17	341 57.8	42 03.3	26.1	173 37.7	49.5	313 09.3	24.8	135 44.1	18.4
18	357 00.3	57 02.5	S22 25.5	188 39.4	N 7 49.2	328 11.8	N10 24.8	150 46.4	S 8 18.5
19	12 02.7	72 01.7	25.0	203 41.0	49.0	343 14.3	24.8	165 48.6	18.6
20	27 05.2	87 00.9	24.4	218 42.7	48.7	358 16.9	24.8	180 50.9	18.6
21	42 07.7	102 00.1	23.8	233 44.3	48.4	13 19.4	24.8	195 53.2	18.7
22	57 10.1	116 59.2	23.2	248 46.0	48.1	28 21.9	24.8	210 55.4	18.8
23	72 12.6	131 58.4	22.6	263 47.7	47.9	43 24.4	24.8	225 57.7	18.8
19 00	87 15.1	146 57.6	S22 22.0	278 49.3	N 7 47.6	58 27.0	N10 24.8	241 00.0	S 8 18.9
01	102 17.5	161 56.8	21.4	293 51.0	47.3	73 29.5	24.8	256 02.2	19.0
02	117 20.0	176 56.0	20.8	308 52.6	47.1	88 32.0	24.8	271 04.5	19.0
03	132 22.4	191 55.2	20.2	323 54.3	46.8	103 34.6	24.7	286 06.8	19.1
04	147 24.9	206 54.4	19.6	338 55.9	46.5	118 37.1	24.7	301 09.1	19.1
05	162 27.4	221 53.6	19.0	353 57.6	46.2	133 39.6	24.7	316 11.3	19.2
06	177 29.8	236 52.8	S22 18.4	8 59.3	N 7 46.0	148 42.1	N10 24.7	331 13.6	S 8 19.3
07	192 32.3	251 52.0	17.8	24 00.9	45.7	163 44.7	24.7	346 15.9	19.3
08	207 34.8	266 51.2	17.2	39 02.6	45.4	178 47.2	24.7	1 18.1	19.4
M 09	222 37.2	281 50.4	16.6	54 04.2	45.2	193 49.7	24.7	16 20.4	19.5
O 10	237 39.7	296 49.6	16.0	69 05.9	44.9	208 52.2	24.7	31 22.7	19.5
N 11	252 42.2	311 48.8	15.4	84 07.6	44.6	223 54.7	24.7	46 25.0	19.6
D 12	267 44.6	326 48.0	S22 14.8	99 09.2	N 7 44.4	238 57.3	N10 24.7	61 27.2	S 8 19.7
A 13	282 47.1	341 47.2	14.2	114 10.9	44.1	253 59.8	24.7	76 29.5	19.7
Y 14	297 49.6	356 46.4	13.6	129 12.6	43.8	269 02.3	24.7	91 31.8	19.8
15	312 52.0	11 45.6	13.0	144 14.2	43.5	284 04.8	24.7	106 34.0	19.8
16	327 54.5	26 44.8	12.4	159 15.9	43.3	299 07.4	24.6	121 36.3	19.9
17	342 56.9	41 44.0	11.8	174 17.6	43.0	314 09.9	24.6	136 38.6	20.0
18	357 59.4	56 43.2	S22 11.1	189 19.2	N 7 42.7	329 12.4	N10 24.6	151 40.9	S 8 20.0
19	13 01.9	71 42.4	10.5	204 20.9	42.5	344 14.9	24.6	166 43.1	20.1
20	28 04.3	86 41.6	09.9	219 22.6	42.2	359 17.4	24.6	181 45.4	20.2
21	43 06.8	101 40.8	09.3	234 24.2	41.9	14 20.0	24.6	196 47.7	20.2
22	58 09.3	116 40.0	08.7	249 25.9	41.7	29 22.5	24.6	211 50.0	20.3
23	73 11.7	131 39.2	08.1	264 27.6	41.4	44 25.0	24.6	226 52.2	20.3
20 00	88 14.2	146 38.4	S22 07.4	279 29.2	N 7 41.1	59 27.5	N10 24.6	241 54.5	S 8 20.4
01	103 16.7	161 37.6	06.8	294 30.9	40.9	74 30.0	24.6	256 56.8	20.5
02	118 19.1	176 36.8	06.2	309 32.6	40.6	89 32.5	24.6	271 59.1	20.5
03	133 21.6	191 36.0	05.6	324 34.2	40.4	104 35.1	24.6	287 01.3	20.6
04	148 24.1	206 35.2	05.0	339 35.9	40.1	119 37.6	24.6	302 03.6	20.7
05	163 26.5	221 34.4	04.3	354 37.6	39.8	134 40.1	24.6	317 05.9	20.7
06	178 29.0	236 33.6	S22 03.7	9 39.3	N 7 39.6	149 42.6	N10 24.6	332 08.2	S 8 20.8
07	193 31.4	251 32.8	03.1	24 40.9	39.3	164 45.1	24.6	347 10.4	20.8
T 08	208 33.9	266 32.0	02.5	39 42.6	39.0	179 47.6	24.5	2 12.7	20.9
U 09	223 36.4	281 31.2	01.8	54 44.3	38.8	194 50.2	24.5	17 15.0	21.0
E 10	238 38.8	296 30.4	01.2	69 46.0	38.5	209 52.7	24.5	32 17.2	21.0
S 11	253 41.3	311 29.7	22 00.6	84 47.6	38.2	224 55.2	24.5	47 19.5	21.1
D 12	268 43.8	326 28.9	S21 59.9	99 49.3	N 7 38.0	239 57.7	N10 24.5	62 21.8	S 8 21.2
A 13	283 46.2	341 28.1	59.3	114 51.0	37.7	255 00.2	24.5	77 24.1	21.2
Y 14	298 48.7	356 27.3	58.7	129 52.7	37.5	270 02.7	24.5	92 26.3	21.3
15	313 51.2	11 26.5	58.0	144 54.4	37.2	285 05.2	24.5	107 28.6	21.3
16	328 53.6	26 25.7	57.4	159 56.0	36.9	300 07.8	24.5	122 30.9	21.4
17	343 56.1	41 24.9	56.7	174 57.7	36.7	315 10.3	24.5	137 33.2	21.5
18	358 58.5	56 24.1	S21 56.1	189 59.4	N 7 36.4	330 12.8	N10 24.5	152 35.5	S 8 21.5
19	14 01.0	71 23.4	55.5	205 01.1	36.2	345 15.3	24.5	167 37.7	21.6
20	29 03.5	86 22.6	54.8	220 02.8	35.9	0 17.8	24.5	182 40.0	21.7
21	44 05.9	101 21.8	54.2	235 04.5	35.6	15 20.3	24.5	197 42.3	21.7
22	59 08.4	116 21.0	53.5	250 06.1	35.4	30 22.8	24.5	212 44.6	21.8
23	74 10.9	131 20.2	52.9	265 07.8	35.1	45 25.3	24.5	227 46.8	21.8
	h m								
Mer. Pass.	18 08.0	*v* −0.8	*d* 0.6	*v* 1.7	*d* 0.3	*v* 2.5	*d* 0.0	*v* 2.3	*d* 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.5
Achernar	335 27.2	S57 10.8
Acrux	173 10.6	S63 09.7
Adhara	255 13.0	S28 59.4
Aldebaran	290 50.2	N16 32.0
Alioth	166 21.7	N55 53.3
Alkaid	153 00.0	N49 14.9
Al Na'ir	27 45.2	S46 54.3
Alnilam	275 47.1	S 1 11.7
Alphard	217 56.9	S 8 42.7
Alphecca	126 12.2	N26 40.4
Alpheratz	357 44.6	N29 09.7
Altair	62 09.6	N 8 54.2
Ankaa	353 16.6	S42 14.6
Antares	112 27.9	S26 27.4
Arcturus	145 56.9	N19 07.1
Atria	107 31.3	S69 02.8
Avior	234 17.9	S59 32.8
Bellatrix	278 32.8	N 6 21.6
Betelgeuse	271 02.1	N 7 24.5
Canopus	263 56.1	S52 42.2
Capella	280 35.5	N46 00.5
Deneb	49 32.6	N45 19.7
Denebola	182 34.7	N14 30.1
Diphda	348 56.8	S17 55.3
Dubhe	193 52.8	N61 40.8
Elnath	278 13.6	N28 37.0
Eltanin	90 47.2	N51 29.3
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.2	S29 33.6
Gacrux	172 02.2	S57 10.6
Gienah	175 53.4	S17 36.5
Hadar	148 49.8	S60 25.6
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 20.8	N74 06.1
Markab	13 39.5	N15 16.4
Menkar	314 15.9	N 4 08.2
Menkent	148 09.1	S36 25.6
Miaplacidus	221 39.3	S69 45.9
Mirfak	308 41.4	N49 54.4
Nunki	76 00.0	S26 16.8
Peacock	53 21.4	S56 41.8
Pollux	243 28.7	N27 59.6
Procyon	245 00.5	N 5 11.5
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.5	N11 54.3
Rigel	281 12.7	S 8 11.3
Rigil Kent.	139 53.6	S60 52.8
Sabik	102 14.1	S15 44.3
Schedar	349 41.6	N56 36.5
Shaula	96 23.8	S37 06.6
Sirius	258 34.3	S16 44.0
Spica	158 32.5	S11 13.4
Suhail	222 52.9	S43 28.8
Vega	80 40.1	N38 47.8
Zuben'ubi	137 06.8	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	59 42.6	14 13
Mars	191 34.3	5 24
Jupiter	331 11.9	20 03
Saturn	153 44.9	7 55

SUNDAY
MONDAY
TUESDAY

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP
d h	° ′	° ′	° ′	′	° ′	′	′
18 00	180 57.3	S23 22.0	272 40.1	11.2	S 2 52.7	13.3	58.8
01	195 57.0	22.1	287 10.3	11.2	3 06.0	13.2	58.8
02	210 56.7	22.2	301 40.5	11.1	3 19.2	13.3	58.8
03	225 56.4	22.3	316 10.6	11.1	3 32.5	13.2	58.9
04	240 56.1	22.3	330 40.7	11.0	3 45.7	13.2	58.9
05	255 55.8	22.4	345 10.7	11.0	3 58.9	13.2	58.9
06	270 55.4	S23 22.5	359 40.7	11.0	S 4 12.1	13.2	58.9
07	285 55.1	22.6	14 10.7	10.9	4 25.3	13.2	59.0
08	300 54.8	22.6	28 40.6	10.9	4 38.5	13.2	59.0
S 09	315 54.5	22.7	43 10.5	10.8	4 51.7	13.1	59.0
U 10	330 54.2	22.8	57 40.3	10.8	5 04.8	13.1	59.0
N 11	345 53.9	22.9	72 10.1	10.8	5 17.9	13.1	59.0
D 12	0 53.6	S23 22.9	86 39.9	10.7	S 5 31.0	13.1	59.1
A 13	15 53.3	23.0	101 09.6	10.6	5 44.1	13.1	59.1
Y 14	30 53.0	23.1	115 39.2	10.6	5 57.2	13.0	59.1
15	45 52.7	23.2	130 08.8	10.6	6 10.2	13.1	59.1
16	60 52.4	23.2	144 38.4	10.5	6 23.3	12.9	59.1
17	75 52.1	23.3	159 07.9	10.4	6 36.2	13.0	59.2
18	90 51.8	S23 23.4	173 37.3	10.4	S 6 49.2	12.9	59.2
19	105 51.5	23.4	188 06.7	10.4	7 02.1	13.0	59.2
20	120 51.1	23.5	202 36.1	10.3	7 15.1	12.8	59.2
21	135 50.8	23.6	217 05.4	10.2	7 27.9	12.9	59.2
22	150 50.5	23.6	231 34.6	10.2	7 40.8	12.8	59.2
23	165 50.2	23.7	246 03.8	10.1	7 53.6	12.8	59.3
19 00	180 49.9	S23 23.8	260 32.9	10.1	S 8 06.4	12.7	59.3
01	195 49.6	23.8	275 02.0	10.0	8 19.1	12.7	59.3
02	210 49.3	23.9	289 31.0	9.9	8 31.8	12.7	59.3
03	225 49.0	23.9	303 59.9	9.9	8 44.5	12.6	59.3
04	240 48.7	24.0	318 28.8	9.8	8 57.1	12.5	59.4
05	255 48.4	24.1	332 57.6	9.8	9 09.6	12.6	59.4
06	270 48.1	S23 24.1	347 26.4	9.7	S 9 22.2	12.5	59.4
07	285 47.8	24.2	1 55.1	9.6	9 34.7	12.4	59.4
08	300 47.4	24.2	16 23.7	9.6	9 47.1	12.4	59.4
M 09	315 47.1	24.3	30 52.3	9.5	9 59.5	12.3	59.5
O 10	330 46.8	24.4	45 20.8	9.5	10 11.8	12.3	59.5
N 11	345 46.5	24.4	59 49.3	9.4	10 24.1	12.3	59.5
D 12	0 46.2	S23 24.5	74 17.7	9.3	S10 36.4	12.2	59.5
A 13	15 45.9	24.5	88 46.0	9.2	10 48.6	12.1	59.5
Y 14	30 45.6	24.6	103 14.2	9.2	11 00.7	12.1	59.5
15	45 45.3	24.6	117 42.4	9.1	11 12.8	12.0	59.6
16	60 45.0	24.7	132 10.5	9.0	11 24.8	12.0	59.6
17	75 44.7	24.7	146 38.5	9.0	11 36.8	11.8	59.6
18	90 44.4	S23 24.8	161 06.5	8.9	S11 48.6	11.9	59.6
19	105 44.0	24.8	175 34.4	8.9	12 00.5	11.8	59.6
20	120 43.7	24.9	190 02.3	8.7	12 12.3	11.7	59.6
21	135 43.4	24.9	204 30.0	8.7	12 24.0	11.6	59.6
22	150 43.1	25.0	218 57.7	8.6	12 35.6	11.6	59.7
23	165 42.8	25.0	233 25.3	8.6	12 47.2	11.5	59.7
20 00	180 42.5	S23 25.0	247 52.9	8.4	S12 58.7	11.4	59.7
01	195 42.2	25.1	262 20.3	8.4	13 10.1	11.4	59.7
02	210 41.9	25.1	276 47.7	8.3	13 21.5	11.2	59.7
03	225 41.6	25.2	291 15.0	8.3	13 32.7	11.2	59.7
04	240 41.3	25.2	305 42.3	8.2	13 43.9	11.2	59.8
05	255 41.0	25.3	320 09.5	8.0	13 55.1	11.0	59.8
06	270 40.6	S23 25.3	334 36.5	8.1	S14 06.1	11.0	59.8
07	285 40.3	25.3	349 03.6	7.9	14 17.1	10.9	59.8
T 08	300 40.0	25.4	3 30.5	7.9	14 28.0	10.8	59.8
U 09	315 39.7	25.4	17 57.4	7.8	14 38.8	10.7	59.8
E 10	330 39.4	25.4	32 24.2	7.7	14 49.5	10.6	59.8
S 11	345 39.1	25.5	46 50.9	7.6	15 00.1	10.6	59.8
D 12	0 38.8	S23 25.5	61 17.5	7.6	S15 10.7	10.4	59.9
A 13	15 38.5	25.5	75 44.1	7.5	15 21.1	10.4	59.9
Y 14	30 38.2	25.6	90 10.6	7.4	15 31.5	10.3	59.9
15	45 37.9	25.6	104 37.0	7.3	15 41.8	10.2	59.9
16	60 37.5	25.6	119 03.3	7.3	15 52.0	10.0	59.9
17	75 37.2	25.7	133 29.6	7.2	16 02.0	10.0	59.9
18	90 36.9	S23 25.7	147 55.8	7.1	S16 12.0	9.9	59.9
19	105 36.6	25.7	162 21.9	7 0	16 21.9	9.8	59.9
20	120 36.3	25.8	176 47.9	7.0	16 31.7	9.7	59.9
21	135 36.0	25.8	191 13.9	6.8	16 41.4	9.6	60.0
22	150 35.7	25.8	205 39.7	6.8	16 51.0	9.4	60.0
23	165 35.4	25.8	220 05.5	6.8	S17 00.4	9.4	60.0
	SD 16.3	d 0.1	SD	16.1		16.2	16.3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 18	Moonrise 19	Moonrise 20	Moonrise 21
	h m	h m	h m	h m	h m	h m	h m
N 72	08 24	10 55	▬	00 29	02 37	05 02	▬
N 70	08 04	09 52	▬	00 25	02 23	04 31	07 02
68	07 48	09 17	▬	00 21	02 12	04 09	06 15
66	07 35	08 52	10 33	00 18	02 02	03 52	05 46
64	07 24	08 32	09 50	00 15	01 55	03 38	05 23
62	07 14	08 16	09 22	00 13	01 48	03 26	05 05
60	07 06	08 03	09 00	00 11	01 42	03 16	04 51
N 58	06 58	07 51	08 43	00 09	01 37	03 08	04 38
56	06 52	07 41	08 28	00 08	01 33	03 00	04 28
54	06 45	07 32	08 15	00 07	01 29	02 53	04 18
52	06 40	07 23	08 04	00 05	01 25	02 47	04 10
50	06 34	07 16	07 54	00 04	01 22	02 42	04 02
45	06 23	07 00	07 34	00 02	01 15	02 30	03 46
N 40	06 12	06 46	07 17	00 00	01 09	02 21	03 33
35	06 03	06 35	07 03	25 04	01 04	02 12	03 22
30	05 54	06 24	06 50	25 00	01 00	02 05	03 12
20	05 38	06 05	06 29	24 52	00 52	01 53	02 56
N 10	05 21	05 48	06 11	24 46	00 46	01 42	02 42
0	05 04	05 31	05 53	24 40	00 40	01 32	02 28
S 10	04 45	05 12	05 36	24 34	00 34	01 23	02 15
20	04 23	04 52	05 17	24 27	00 27	01 12	02 01
30	03 54	04 27	04 55	24 20	00 20	01 00	01 45
35	03 35	04 12	04 42	24 16	00 16	00 54	01 36
40	03 12	03 54	04 26	24 11	00 11	00 46	01 25
45	02 41	03 31	04 08	24 06	00 06	00 37	01 13
S 50	01 56	03 01	03 46	24 00	00 00	00 26	00 58
52	01 28	02 46	03 35	23 57	24 21	00 21	00 51
54	00 42	02 28	03 23	23 54	24 16	00 16	00 43
56	////	02 06	03 08	23 50	24 10	00 10	00 35
58	////	01 36	02 52	23 46	24 03	00 03	00 25
S 60	////	00 46	02 31	23 42	23 56	24 14	00 14

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 18	Moonset 19	Moonset 20	Moonset 21
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	12 59	15 30	11 03	10 41	10 08	▬
N 70	▬	14 01	15 50	11 10	10 57	10 40	10 08
68	▬	14 36	16 06	11 17	11 11	11 04	10 55
66	13 21	15 02	16 19	11 22	11 22	11 23	11 26
64	14 03	15 21	16 30	11 26	11 31	11 38	11 49
62	14 32	15 38	16 40	11 30	11 39	11 50	12 08
60	14 53	15 51	16 48	11 33	11 46	12 01	12 23
N 58	15 11	16 03	16 55	11 36	11 52	12 11	12 36
56	15 26	16 13	17 02	11 39	11 57	12 19	12 47
54	15 38	16 22	17 08	11 42	12 02	12 26	12 57
52	15 49	16 30	17 14	11 44	12 06	12 33	13 06
50	15 59	16 38	17 19	11 46	12 10	12 39	13 14
45	16 20	16 54	17 31	11 50	12 19	12 52	13 31
N 40	16 37	17 07	17 42	11 54	12 26	13 03	13 45
35	16 51	17 19	17 51	11 57	12 33	13 12	13 57
30	17 03	17 30	18 00	12 00	12 38	13 20	14 08
20	17 25	17 49	18 16	12 05	12 48	13 35	14 26
N 10	17 43	18 06	18 32	12 09	12 56	13 47	14 41
0	18 01	18 23	18 49	12 13	13 04	13 59	14 56
S 10	18 18	18 41	19 08	12 17	13 12	14 10	15 11
20	18 37	19 02	19 31	12 22	13 21	14 23	15 26
30	18 59	19 27	20 00	12 27	13 31	14 37	15 45
35	19 12	19 42	20 19	12 29	13 37	14 45	15 55
40	19 27	20 00	20 42	12 33	13 43	14 55	16 07
45	19 45	20 23	21 13	12 36	13 51	15 06	16 22
S 50	20 08	20 53	21 58	12 41	14 00	15 20	16 39
52	20 19	21 08	22 26	12 43	14 04	15 26	16 48
54	20 31	21 26	23 13	12 45	14 09	15 33	16 57
56	20 45	21 48	////	12 48	14 14	15 41	17 07
58	21 02	22 18	////	12 51	14 20	15 50	17 19
S 60	21 23	23 09	////	12 54	14 26	16 00	17 33

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
18	03 50	03 35	11 56	06 01	18 26	23	45
19	03 20	03 05	11 57	06 52	19 18	24	34
20	02 51	02 36	11 57	07 45	20 13	25	23

UT	ARIES	VENUS −3.9		MARS +0.4		JUPITER −2.6		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
21 00	89 13.3	146 19.4	S21 52.3	280 09.5	N 7 34.9	60 27.8	N10 24.5	242 49.1	S 8 21.9
01	104 15.8	161 18.7	51.6	295 11.2	34.6	75 30.4	24.5	257 51.4	22.0
02	119 18.3	176 17.9	51.0	310 12.9	34.3	90 32.9	24.5	272 53.7	22.0
03	134 20.7	191 17.1	50.3	325 14.6	34.1	105 35.4	24.5	287 55.9	22.1
04	149 23.2	206 16.3	49.7	340 16.3	33.8	120 37.9	24.5	302 58.2	22.1
05	164 25.7	221 15.5	49.0	355 18.0	33.6	135 40.4	24.5	318 00.5	22.2
06	179 28.1	236 14.7	S21 48.4	10 19.6	N 7 33.3	150 42.9	N10 24.5	333 02.8	S 8 22.3
W 07	194 30.6	251 14.0	47.7	25 21.3	33.1	165 45.4	24.5	348 05.0	22.3
E 08	209 33.0	266 13.2	47.0	40 23.0	32.8	180 47.9	24.5	3 07.3	22.4
D 09	224 35.5	281 12.4	46.4	55 24.7	32.5	195 50.4	24.5	18 09.6	22.5
N 10	239 38.0	296 11.6	45.7	70 26.4	32.3	210 52.9	24.5	33 11.9	22.5
E 11	254 40.4	311 10.9	45.1	85 28.1	32.0	225 55.4	24.5	48 14.2	22.6
S 12	269 42.9	326 10.1	S21 44.4	100 29.8	N 7 31.8	240 57.9	N10 24.5	63 16.4	S 8 22.6
D 13	284 45.4	341 09.3	43.8	115 31.5	31.5	256 00.4	24.5	78 18.7	22.7
A 14	299 47.8	356 08.5	43.1	130 33.2	31.3	271 03.0	24.5	93 21.0	22.8
Y 15	314 50.3	11 07.8	42.4	145 34.9	31.0	286 05.5	24.5	108 23.3	22.8
16	329 52.8	26 07.0	41.8	160 36.6	30.8	301 08.0	24.5	123 25.5	22.9
17	344 55.2	41 06.2	41.1	175 38.3	30.5	316 10.5	24.4	138 27.8	22.9
18	359 57.7	56 05.4	S21 40.4	190 40.0	N 7 30.2	331 13.0	N10 24.4	153 30.1	S 8 23.0
19	15 00.2	71 04.7	39.8	205 41.7	30.0	346 15.5	24.4	168 32.4	23.1
20	30 02.6	86 03.9	39.1	220 43.4	29.7	1 18.0	24.4	183 34.7	23.1
21	45 05.1	101 03.1	38.4	235 45.1	29.5	16 20.5	24.4	198 36.9	23.2
22	60 07.5	116 02.3	37.8	250 46.8	29.2	31 23.0	24.4	213 39.2	23.2
23	75 10.0	131 01.6	37.1	265 48.5	29.0	46 25.5	24.4	228 41.5	23.3
22 00	90 12.5	146 00.8	S21 36.4	280 50.2	N 7 28.7	61 28.0	N10 24.4	243 43.8	S 8 23.4
01	105 14.9	161 00.0	35.7	295 51.9	28.5	76 30.5	24.4	258 46.1	23.4
02	120 17.4	175 59.3	35.1	310 53.6	28.2	91 33.0	24.4	273 48.3	23.5
03	135 19.9	190 58.5	34.4	325 55.3	28.0	106 35.5	24.4	288 50.6	23.5
04	150 22.3	205 57.7	33.7	340 57.0	27.7	121 38.0	24.4	303 52.9	23.6
05	165 24.8	220 57.0	33.0	355 58.7	27.5	136 40.5	24.4	318 55.2	23.7
06	180 27.3	235 56.2	S21 32.4	11 00.4	N 7 27.2	151 43.0	N10 24.4	333 57.5	S 8 23.7
T 07	195 29.7	250 55.4	31.7	26 02.1	27.0	166 45.5	24.5	348 59.7	23.8
H 08	210 32.2	265 54.7	31.0	41 03.8	26.7	181 48.0	24.5	4 02.0	23.8
U 09	225 34.7	280 53.9	30.3	56 05.5	26.5	196 50.5	24.5	19 04.3	23.9
R 10	240 37.1	295 53.1	29.6	71 07.2	26.2	211 53.0	24.5	34 06.6	24.0
S 11	255 39.6	310 52.4	29.0	86 08.9	26.0	226 55.5	24.5	49 08.9	24.0
D 12	270 42.0	325 51.6	S21 28.3	101 10.7	N 7 25.7	241 58.0	N10 24.5	64 11.1	S 8 24.1
A 13	285 44.5	340 50.8	27.6	116 12.4	25.5	257 00.5	24.5	79 13.4	24.1
Y 14	300 47.0	355 50.1	26.9	131 14.1	25.2	272 03.0	24.5	94 15.7	24.2
15	315 49.4	10 49.3	26.2	146 15.8	25.0	287 05.5	24.5	109 18.0	24.3
16	330 51.9	25 48.6	25.5	161 17.5	24.7	302 08.0	24.5	124 20.3	24.3
17	345 54.4	40 47.8	24.8	176 19.2	24.5	317 10.5	24.5	139 22.6	24.4
18	0 56.8	55 47.0	S21 24.1	191 20.9	N 7 24.2	332 13.0	N10 24.5	154 24.8	S 8 24.4
19	15 59.3	70 46.3	23.4	206 22.6	24.0	347 15.5	24.5	169 27.1	24.5
20	31 01.8	85 45.5	22.8	221 24.4	23.7	2 17.9	24.5	184 29.4	24.5
21	46 04.2	100 44.8	22.1	236 26.1	23.5	17 20.4	24.5	199 31.7	24.6
22	61 06.7	115 44.0	21.4	251 27.8	23.3	32 22.9	24.5	214 34.0	24.7
23	76 09.2	130 43.3	20.7	266 29.5	23.0	47 25.4	24.5	229 36.2	24.7
23 00	91 11.6	145 42.5	S21 20.0	281 31.2	N 7 22.8	62 27.9	N10 24.5	244 38.5	S 8 24.8
01	106 14.1	160 41.7	19.3	296 32.9	22.5	77 30.4	24.5	259 40.8	24.8
02	121 16.5	175 41.0	18.6	311 34.7	22.3	92 32.9	24.5	274 43.1	24.9
03	136 19.0	190 40.2	17.9	326 36.4	22.0	107 35.4	24.5	289 45.4	25.0
04	151 21.5	205 39.5	17.2	341 38.1	21.8	122 37.9	24.5	304 47.7	25.0
05	166 23.9	220 38.7	16.5	356 39.8	21.5	137 40.4	24.5	319 49.9	25.1
06	181 26.4	235 38.0	S21 15.8	11 41.5	N 7 21.3	152 42.9	N10 24.5	334 52.2	S 8 25.1
07	196 28.9	250 37.2	15.1	26 43.3	21.1	167 45.4	24.5	349 54.5	25.2
08	211 31.3	265 36.5	14.3	41 45.0	20.8	182 47.9	24.5	4 56.8	25.3
F 09	226 33.8	280 35.7	13.6	56 46.7	20.6	197 50.3	24.5	19 59.1	25.3
R 10	241 36.3	295 35.0	12.9	71 48.4	20.3	212 52.8	24.5	35 01.4	25.4
I 11	256 38.7	310 34.2	12.2	86 50.2	20.1	227 55.3	24.5	50 03.6	25.4
D 12	271 41.2	325 33.5	S21 11.5	101 51.9	N 7 19.8	242 57.8	N10 24.5	65 05.9	S 8 25.5
A 13	286 43.6	340 32.7	10.8	116 53.6	19.6	258 00.3	24.5	80 08.2	25.5
Y 14	301 46.1	355 32.0	10.1	131 55.3	19.4	273 02.8	24.5	95 10.5	25.6
15	316 48.6	10 31.2	09.4	146 57.1	19.1	288 05.3	24.5	110 12.8	25.7
16	331 51.0	25 30.5	08.7	161 58.8	18.9	303 07.8	24.6	125 15.1	25.7
17	346 53.5	40 29.7	07.9	177 00.5	18.6	318 10.3	24.6	140 17.3	25.8
18	1 56.0	55 29.0	S21 07.2	192 02.3	N 7 18.4	333 12.7	N10 24.6	155 19.6	S 8 25.8
19	16 58.4	70 28.2	06.5	207 04.0	18.2	348 15.2	24.6	170 21.9	25.9
20	32 00.9	85 27.5	05.8	222 05.7	17.9	3 17.7	24.6	185 24.2	25.9
21	47 03.4	100 26.8	05.1	237 07.5	17.7	18 20.2	24.6	200 26.5	26.0
22	62 05.8	115 26.0	04.4	252 09.2	17.4	33 22.7	24.6	215 28.8	26.1
23	77 08.3	130 25.3	03.6	267 10.9	17.2	48 25.2	24.6	230 31.1	26.1
	h m								
Mer. Pass.	17 56.2	v −0.8	d 0.7	v 1.7	d 0.2	v 2.5	d 0.0	v 2.3	d 0.1

STARS

Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.6
Achernar	335 27.3	S57 10.8
Acrux	173 10.6	S63 09.7
Adhara	255 13.0	S28 59.4
Aldebaran	290 50.2	N16 32.0
Alioth	166 21.7	N55 53.3
Alkaid	152 59.9	N49 14.9
Al Na'ir	27 45.2	S46 54.3
Alnilam	275 47.1	S 1 11.8
Alphard	217 56.9	S 8 42.7
Alphecca	126 12.2	N26 40.4
Alpheratz	357 44.6	N29 09.7
Altair	62 09.6	N 8 54.2
Ankaa	353 16.6	S42 14.6
Antares	112 27.9	S26 27.4
Arcturus	145 56.9	N19 07.1
Atria	107 31.2	S69 02.8
Avior	234 17.9	S59 32.8
Bellatrix	278 32.8	N 6 21.5
Betelgeuse	271 02.1	N 7 24.5
Canopus	263 56.0	S52 42.2
Capella	280 35.5	N46 00.6
Deneb	49 32.6	N45 19.7
Denebola	182 34.7	N14 30.1
Diphda	348 56.9	S17 55.3
Dubhe	193 52.8	N61 40.8
Elnath	278 13.5	N28 37.0
Eltanin	90 47.2	N51 29.3
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.2	S29 33.6
Gacrux	172 02.2	S57 10.6
Gienah	175 53.4	S17 36.5
Hadar	148 49.8	S60 25.6
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 20.8	N74 06.1
Markab	13 39.5	N15 16.4
Menkar	314 15.9	N 4 08.2
Menkent	148 09.0	S36 25.6
Miaplacidus	221 39.3	S69 45.9
Mirfak	308 41.4	N49 54.4
Nunki	76 00.0	S26 16.8
Peacock	53 21.4	S56 41.8
Pollux	243 28.7	N27 59.6
Procyon	245 00.5	N 5 11.5
Rasalhague	96 07.8	N12 33.2
Regulus	207 44.5	N11 54.3
Rigel	281 12.7	S 8 11.4
Rigil Kent.	139 53.6	S60 52.8
Sabik	102 14.1	S15 44.3
Schedar	349 41.6	N56 36.6
Shaula	96 23.8	S37 06.6
Sirius	258 34.3	S16 44.1
Spica	158 32.5	S11 13.4
Suhail	222 52.9	S43 28.8
Vega	80 40.1	N38 47.8
Zuben'ubi	137 06.8	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	55 48.3	14 17
Mars	190 37.7	5 16
Jupiter	331 15.5	19 51
Saturn	153 31.3	7 44

UT	SUN GHA	SUN Dec	MOON GHA	MOON v	MOON Dec	MOON d	MOON HP
d h	° ′	° ′	° ′	′	° ′	′	′
21 00	180 35.1	S23 25.9	234 31.3	6.6	S17 09.8	9.3	60.0
01	195 34.7	25.9	248 56.9	6.6	17 19.1	9.1	60.0
02	210 34.4	25.9	263 22.5	6.5	17 28.2	9.1	60.0
03	225 34.1	25.9	277 48.0	6.4	17 37.3	8.9	60.0
04	240 33.8	25.9	292 13.4	6.4	17 46.2	8.8	60.0
05	255 33.5	26.0	306 38.8	6.3	17 55.0	8.7	60.0
06	270 33.2	S23 26.0	321 04.1	6.2	S18 03.7	8.6	60.0
W 07	285 32.9	26.0	335 29.3	6.1	18 12.3	8.5	60.0
E 08	300 32.6	26.0	349 54.4	6.1	18 20.8	8.4	60.0
D 09	315 32.3	26.0	4 19.5	6.0	18 29.2	8.2	60.1
N 10	330 31.9	26.1	18 44.5	5.9	18 37.4	8.1	60.1
E 11	345 31.6	26.1	33 09.4	5.8	18 45.5	8.0	60.1
S 12	0 31.3	S23 26.1	47 34.2	5.8	S18 53.5	7.9	60.1
D 13	15 31.0	26.1	61 59.0	5.7	19 01.4	7.7	60.1
A 14	30 30.7	26.1	76 23.7	5.7	19 09.1	7.6	60.1
Y 15	45 30.4	26.1	90 48.4	5.6	19 16.7	7.5	60.1
16	60 30.1	26.1	105 13.0	5.5	19 24.2	7.4	60.1
17	75 29.8	26.1	119 37.5	5.4	19 31.6	7.2	60.1
18	90 29.5	S23 26.2	134 01.9	5.4	S19 38.8	7.1	60.1
19	105 29.1	26.2	148 26.3	5.4	19 45.9	6.9	60.1
20	120 28.8	26.2	162 50.7	5.2	19 52.8	6.9	60.1
21	135 28.5	26.2	177 14.9	5.2	19 59.7	6.7	60.1
22	150 28.2	26.2	191 39.1	5.2	20 06.4	6.5	60.1
23	165 27.9	26.2	206 03.3	5.1	20 12.9	6.4	60.1
22 00	180 27.6	S23 26.2	220 27.4	5.0	S20 19.3	6.3	60.1
01	195 27.3	26.2	234 51.4	5.0	20 25.6	6.1	60.1
02	210 27.0	26.2	249 15.4	4.9	20 31.7	6.0	60.1
03	225 26.7	26.2	263 39.3	4.9	20 37.7	5.9	60.1
04	240 26.3	26.2	278 03.2	4.8	20 43.6	5.7	60.1
05	255 26.0	26.2	292 27.0	4.7	20 49.3	5.6	60.1
06	270 25.7	S23 26.2	306 50.7	4.8	S20 54.9	5.4	60.1
T 07	285 25.4	26.2	321 14.5	4.6	21 00.3	5.3	60.1
H 08	300 25.1	26.2	335 38.1	4.7	21 05.6	5.1	60.1
U 09	315 24.8	26.2	350 01.8	4.6	21 10.7	5.0	60.1
R 10	330 24.5	26.2	4 25.4	4.5	21 15.7	4.8	60.1
S 11	345 24.2	26.2	18 48.9	4.5	21 20.5	4.7	60.1
D 12	0 23.8	S23 26.2	33 12.4	4.5	S21 25.2	4.5	60.1
A 13	15 23.5	26.2	47 35.9	4.4	21 29.7	4.4	60.1
Y 14	30 23.2	26.2	61 59.3	4.4	21 34.1	4.2	60.1
15	45 22.9	26.2	76 22.7	4.3	21 38.3	4.1	60.1
16	60 22.6	26.2	90 46.0	4.3	21 42.4	3.9	60.1
17	75 22.3	26.2	105 09.3	4.3	21 46.3	3.8	60.1
18	90 22.0	S23 26.1	119 32.6	4.3	S21 50.1	3.6	60.1
19	105 21.7	26.1	133 55.9	4.2	21 53.7	3.4	60.1
20	120 21.4	26.1	148 19.1	4.2	21 57.1	3.4	60.1
21	135 21.0	26.1	162 42.3	4.2	22 00.5	3.1	60.0
22	150 20.7	26.1	177 05.5	4.2	22 03.6	3.0	60.0
23	165 20.4	26.1	191 28.7	4.1	22 06.6	2.8	60.0
23 00	180 20.1	S23 26.1	205 51.8	4.2	S22 09.4	2.7	60.0
01	195 19.8	26.0	220 15.0	4.1	22 12.1	2.5	60.0
02	210 19.5	26.0	234 38.1	4.1	22 14.6	2.4	60.0
03	225 19.2	26.0	249 01.2	4.1	22 17.0	2.2	60.0
04	240 18.9	26.0	263 24.3	4.0	22 19.2	2.0	60.0
05	255 18.5	26.0	277 47.3	4.1	22 21.2	1.9	60.0
06	270 18.2	S23 26.0	292 10.4	4.1	S22 23.1	1.7	60.0
07	285 17.9	25.9	306 33.5	4.0	22 24.8	1.6	60.0
08	300 17.6	25.9	320 56.5	4.1	22 26.4	1.4	60.0
F 09	315 17.3	25.9	335 19.6	4.0	22 27.8	1.2	59.9
R 10	330 17.0	25.9	349 42.6	4.1	22 29.0	1.1	59.9
I 11	345 16.7	25.8	4 05.7	4.1	22 30.1	0.9	59.9
D 12	0 16.4	S23 25.8	18 28.8	4.0	S22 31.0	0.8	59.9
A 13	15 16.0	25.8	32 51.8	4.1	22 31.8	0.6	59.9
Y 14	30 15.7	25.8	47 14.9	4.1	22 32.4	0.5	59.9
15	45 15.4	25.7	61 38.0	4.1	22 32.9	0.2	59.9
16	60 15.1	25.7	76 01.1	4.2	22 33.1	0.2	59.9
17	75 14.8	25.7	90 24.3	4.1	22 33.3	0.1	59.8
18	90 14.5	S23 25.7	104 47.4	4.2	S22 33.2	0.2	59.8
19	105 14.2	25.6	119 10.6	4.1	22 33.0	0.3	59.8
20	120 13.9	25.6	133 33.7	4.2	22 32.7	0.5	59.8
21	135 13.6	25.6	147 56.9	4.3	22 32.2	0.7	59.8
22	150 13.2	25.5	162 20.2	4.2	22 31.5	0.8	59.8
23	165 12.9	25.5	176 43.4	4.3	S22 30.7	1.0	59.7
	SD 16.3	d 0.0	SD 16.4		16.4		16.3

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 21	Moonrise 22	Moonrise 23	Moonrise 24
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 26	10 58	▬	▬	▬	▬	▬
N 70	08 06	09 55	▬	07 02	▬	▬	▬
68	07 50	09 19	▬	06 15	08 39	▬	▬
66	07 37	08 54	10 35	05 46	07 40	09 17	10 10
64	07 26	08 34	09 52	05 23	07 06	08 32	09 29
62	07 16	08 18	09 24	05 05	06 41	08 03	09 01
60	07 08	08 04	09 02	04 51	06 21	07 40	08 39
N 58	07 00	07 53	08 45	04 38	06 05	07 22	08 21
56	06 53	07 42	08 30	04 28	05 52	07 06	08 06
54	06 47	07 33	08 17	04 18	05 40	06 53	07 53
52	06 41	07 25	08 06	04 10	05 30	06 42	07 42
50	06 36	07 18	07 56	04 02	05 20	06 32	07 32
45	06 24	07 02	07 35	03 46	05 01	06 10	07 11
N 40	06 14	06 48	07 19	03 33	04 45	05 53	06 54
35	06 04	06 36	07 04	03 22	04 32	05 38	06 39
30	05 56	06 26	06 52	03 12	04 20	05 26	06 27
20	05 39	06 07	06 31	02 56	04 00	05 04	06 06
N 10	05 23	05 49	06 12	02 42	03 43	04 46	05 47
0	05 06	05 32	05 55	02 28	03 27	04 28	05 30
S 10	04 47	05 14	05 37	02 15	03 11	04 11	05 12
20	04 24	04 53	05 18	02 01	02 54	03 52	04 54
30	03 55	04 28	04 56	01 45	02 35	03 31	04 32
35	03 36	04 13	04 43	01 36	02 24	03 19	04 20
40	03 13	03 55	04 28	01 25	02 11	03 05	04 06
45	02 42	03 32	04 10	01 13	01 56	02 48	03 49
S 50	01 57	03 02	03 47	00 58	01 37	02 27	03 27
52	01 29	02 47	03 36	00 51	01 29	02 17	03 17
54	00 41	02 29	03 24	00 43	01 19	02 06	03 06
56	////	02 07	03 10	00 35	01 08	01 54	02 53
58	////	01 37	02 53	00 25	00 56	01 39	02 38
S 60	////	00 46	02 32	00 14	00 41	01 22	02 20

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 21	Moonset 22	Moonset 23	Moonset 24
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	12 59	15 31	▬	▬	▬	▬
N 70	▬	14 02	15 51	10 08	▬	▬	▬
68	▬	14 37	16 07	10 55	10 37	▬	▬
66	13 22	15 03	16 20	11 26	11 36	12 07	13 23
64	14 04	15 23	16 31	11 49	12 11	12 52	14 03
62	14 33	15 39	16 41	12 08	12 36	13 22	14 31
60	14 55	15 52	16 49	12 23	12 56	13 45	14 53
N 58	15 12	16 04	16 57	12 36	13 12	14 03	15 10
56	15 27	16 14	17 04	12 47	13 26	14 18	15 25
54	15 40	16 23	17 10	12 57	13 38	14 31	15 38
52	15 51	16 32	17 15	13 06	13 49	14 43	15 49
50	16 01	16 39	17 21	13 14	13 58	14 53	15 59
45	16 21	16 55	17 33	13 31	14 18	15 15	16 19
N 40	16 38	17 09	17 43	13 45	14 35	15 32	16 36
35	16 52	17 21	17 52	13 57	14 49	15 47	16 50
30	17 05	17 31	18 01	14 08	15 01	16 00	17 03
20	17 26	17 50	18 18	14 26	15 21	16 21	17 23
N 10	17 45	18 08	18 34	14 41	15 39	16 40	17 42
0	18 02	18 25	18 51	14 56	15 56	16 58	17 58
S 10	18 20	18 43	19 10	15 11	16 13	17 15	18 15
20	18 39	19 03	19 33	15 26	16 31	17 34	18 33
30	19 01	19 28	20 02	15 45	16 51	17 55	18 54
35	19 14	19 44	20 20	15 55	17 04	18 08	19 06
40	19 29	20 02	20 44	16 07	17 18	18 22	19 19
45	19 47	20 25	21 14	16 22	17 34	18 40	19 36
S 50	20 10	20 54	22 00	16 39	17 54	19 01	19 55
52	20 21	21 09	22 28	16 48	18 04	19 11	20 05
54	20 33	21 28	23 15	16 57	18 15	19 22	20 15
56	20 47	21 50	////	17 07	18 27	19 35	20 27
58	21 04	22 20	////	17 19	18 42	19 50	20 41
S 60	21 25	23 11	////	17 33	18 59	20 08	20 57

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
21	02 21	02 06	11 58	08 42	21 11	26	14
22	01 51	01 36	11 58	09 42	22 12	27	7
23	01 21	01 06	11 59	10 43	23 14	28	2

UT	ARIES	VENUS −3.9		MARS +0.3		JUPITER −2.6		SATURN +0.7		STARS		
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec	Name	SHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′		° ′	° ′
24 00	92 10.8	145 24.5	S21 02.9	282 12.7	N 7 17.0	63 27.7	N10 24.6	245 33.3	S 8 26.2	Acamar	315 18.8	S40 15.6
01	107 13.2	160 23.8	02.2	297 14.4	16.7	78 30.1	24.6	260 35.6	26.2	Achernar	335 27.3	S57 10.8
02	122 15.7	175 23.0	01.5	312 16.1	16.5	93 32.6	24.6	275 37.9	26.3	Acrux	173 10.5	S63 09.7
03	137 18.1	190 22.3	00.7	327 17.9	16.3	108 35.1	24.6	290 40.2	26.4	Adhara	255 13.0	S28 59.4
04	152 20.6	205 21.6	21 00.0	342 19.6	16.0	123 37.6	24.6	305 42.5	26.4	Aldebaran	290 50.2	N16 32.0
05	167 23.1	220 20.8	20 59.3	357 21.3	15.8	138 40.1	24.6	320 44.8	26.5			
06	182 25.5	235 20.1	S20 58.5	12 23.1	N 7 15.5	153 42.6	N10 24.6	335 47.1	S 8 26.5	Alioth	166 21.7	N55 53.3
07	197 28.0	250 19.3	57.8	27 24.8	15.3	168 45.0	24.6	350 49.3	26.6	Alkaid	152 59.9	N49 14.9
S 08	212 30.5	265 18.6	57.1	42 26.6	15.1	183 47.5	24.7	5 51.6	26.6	Al Na'ir	27 45.3	S46 54.2
A 09	227 32.9	280 17.9	56.4	57 28.3	14.8	198 50.0	24.7	20 53.9	26.7	Alnilam	275 47.1	S 1 11.8
T 10	242 35.4	295 17.1	55.6	72 30.0	14.6	213 52.5	24.7	35 56.2	26.8	Alphard	217 56.9	S 8 42.8
U 11	257 37.9	310 16.4	54.9	87 31.8	14.4	228 55.0	24.7	50 58.5	26.8			
R 12	272 40.3	325 15.7	S20 54.1	102 33.5	N 7 14.1	243 57.5	N10 24.7	66 00.8	S 8 26.9	Alphecca	126 12.2	N26 40.4
D 13	287 42.8	340 14.9	53.4	117 35.3	13.9	258 59.9	24.7	81 03.1	26.9	Alpheratz	357 44.6	N29 09.7
A 14	302 45.3	355 14.2	52.7	132 37.0	13.7	274 02.4	24.7	96 05.4	27.0	Altair	62 09.6	N 8 54.2
Y 15	317 47.7	10 13.5	51.9	147 38.8	13.4	289 04.9	24.7	111 07.6	27.0	Ankaa	353 16.7	S42 14.6
16	332 50.2	25 12.7	51.2	162 40.5	13.2	304 07.4	24.7	126 09.9	27.1	Antares	112 27.9	S26 27.4
17	347 52.6	40 12.0	50.5	177 42.3	13.0	319 09.9	24.7	141 12.2	27.1			
18	2 55.1	55 11.3	S20 49.7	192 44.0	N 7 12.7	334 12.3	N10 24.7	156 14.5	S 8 27.2	Arcturus	145 56.8	N19 07.1
19	17 57.6	70 10.5	49.0	207 45.8	12.5	349 14.8	24.7	171 16.8	27.3	Atria	107 31.2	S69 02.8
20	33 00.0	85 09.8	48.2	222 47.5	12.3	4 17.3	24.8	186 19.1	27.3	Avior	234 17.9	S59 32.9
21	48 02.5	100 09.1	47.5	237 49.3	12.0	19 19.8	24.8	201 21.4	27.4	Bellatrix	278 32.8	N 6 21.5
22	63 05.0	115 08.3	46.7	252 51.0	11.8	34 22.2	24.8	216 23.7	27.4	Betelgeuse	271 02.1	N 7 24.4
23	78 07.4	130 07.6	46.0	267 52.8	11.6	49 24.7	24.8	231 26.0	27.5			
25 00	93 09.9	145 06.9	S20 45.2	282 54.5	N 7 11.3	64 27.2	N10 24.8	246 28.2	S 8 27.5	Canopus	263 56.0	S52 42.2
01	108 12.4	160 06.2	44.5	297 56.3	11.1	79 29.7	24.8	261 30.5	27.6	Capella	280 35.5	N46 00.6
02	123 14.8	175 05.4	43.7	312 58.0	10.9	94 32.1	24.8	276 32.8	27.7	Deneb	49 32.6	N45 19.7
03	138 17.3	190 04.7	43.0	327 59.8	10.7	109 34.6	24.8	291 35.1	27.7	Denebola	182 34.7	N14 30.1
04	153 19.8	205 04.0	42.2	343 01.5	10.4	124 37.1	24.8	306 37.4	27.8	Diphda	348 56.9	S17 55.3
05	168 22.2	220 03.3	41.5	358 03.3	10.2	139 39.6	24.8	321 39.7	27.8			
06	183 24.7	235 02.5	S20 40.7	13 05.0	N 7 10.0	154 42.0	N10 24.8	336 42.0	S 8 27.9	Dubhe	193 52.7	N61 40.8
07	198 27.1	250 01.8	40.0	28 06.8	09.7	169 44.5	24.9	351 44.3	27.9	Elnath	278 13.5	N28 37.0
08	213 29.6	265 01.1	39.2	43 08.5	09.5	184 47.0	24.9	6 46.6	28.0	Eltanin	90 47.2	N51 29.3
S 09	228 32.1	280 00.4	38.5	58 10.3	09.3	199 49.5	24.9	21 48.8	28.0	Enif	33 48.3	N 9 56.0
U 10	243 34.5	294 59.6	37.7	73 12.1	09.1	214 51.9	24.9	36 51.1	28.1	Fomalhaut	15 25.2	S29 33.6
N 11	258 37.0	309 58.9	37.0	88 13.8	08.8	229 54.4	24.9	51 53.4	28.2			
D 12	273 39.5	324 58.2	S20 36.2	103 15.6	N 7 08.6	244 56.9	N10 24.9	66 55.7	S 8 28.2	Gacrux	172 02.1	S57 10.6
A 13	288 41.9	339 57.5	35.4	118 17.3	08.4	259 59.4	24.9	81 58.0	28.3	Gienah	175 53.4	S17 36.5
Y 14	303 44.4	354 56.8	34.7	133 19.1	08.1	275 01.8	24.9	97 00.3	28.3	Hadar	148 49.7	S60 25.6
15	318 46.9	9 56.0	33.9	148 20.9	07.9	290 04.3	24.9	112 02.6	28.4	Hamal	328 01.7	N23 31.3
16	333 49.3	24 55.3	33.1	163 22.6	07.7	305 06.8	25.0	127 04.9	28.4	Kaus Aust.	83 45.6	S34 22.6
17	348 51.8	39 54.6	32.4	178 24.4	07.5	320 09.2	25.0	142 07.2	28.5			
18	3 54.3	54 53.9	S20 31.6	193 26.1	N 7 07.2	335 11.7	N10 25.0	157 09.5	S 8 28.5	Kochab	137 20.7	N74 06.1
19	18 56.7	69 53.2	30.8	208 27.9	07.0	350 14.2	25.0	172 11.8	28.6	Markab	13 39.5	N15 16.4
20	33 59.2	84 52.4	30.1	223 29.7	06.8	5 16.7	25.0	187 14.0	28.7	Menkar	314 15.9	N 4 08.2
21	49 01.6	99 51.7	29.3	238 31.4	06.6	20 19.1	25.0	202 16.3	28.7	Menkent	148 09.0	S36 25.6
22	64 04.1	114 51.0	28.5	253 33.2	06.3	35 21.6	25.0	217 18.6	28.8	Miaplacidus	221 39.2	S69 45.9
23	79 06.6	129 50.3	27.8	268 35.0	06.1	50 24.1	25.0	232 20.9	28.8			
26 00	94 09.0	144 49.6	S20 27.0	283 36.7	N 7 05.9	65 26.5	N10 25.0	247 23.2	S 8 28.9	Mirfak	308 41.4	N49 54.4
01	109 11.5	159 48.9	26.2	298 38.5	05.7	80 29.0	25.1	262 25.5	28.9	Nunki	76 00.0	S26 16.8
02	124 14.0	174 48.2	25.4	313 40.3	05.5	95 31.5	25.1	277 27.8	29.0	Peacock	53 21.4	S56 41.8
03	139 16.4	189 47.4	24.7	328 42.1	05.2	110 33.9	25.1	292 30.1	29.0	Pollux	243 28.6	N27 59.6
04	154 18.9	204 46.7	23.9	343 43.8	05.0	125 36.4	25.1	307 32.4	29.1	Procyon	245 00.5	N 5 11.5
05	169 21.4	219 46.0	23.1	358 45.6	04.8	140 38.9	25.1	322 34.7	29.1			
06	184 23.8	234 45.3	S20 22.3	13 47.4	N 7 04.6	155 41.3	N10 25.1	337 37.0	S 8 29.2	Rasalhague	96 07.8	N12 33.1
07	199 26.3	249 44.6	21.6	28 49.1	04.3	170 43.8	25.1	352 39.3	29.3	Regulus	207 44.4	N11 54.3
08	214 28.8	264 43.9	20.8	43 50.9	04.1	185 46.3	25.2	7 41.6	29.3	Rigel	281 12.7	S 8 11.4
M 09	229 31.2	279 43.2	20.0	58 52.7	03.9	200 48.7	25.2	22 43.8	29.4	Rigil Kent.	139 53.5	S60 52.8
O 10	244 33.7	294 42.5	19.2	73 54.5	03.7	215 51.2	25.2	37 46.1	29.4	Sabik	102 14.1	S15 44.3
N 11	259 36.1	309 41.8	18.4	88 56.3	03.5	230 53.7	25.2	52 48.4	29.5			
D 12	274 38.6	324 41.1	S20 17.7	103 58.0	N 7 03.2	245 56.1	N10 25.2	67 50.7	S 8 29.5	Schedar	349 41.6	N56 36.6
A 13	289 41.1	339 40.4	16.9	118 59.8	03.0	260 58.6	25.2	82 53.0	29.6	Shaula	96 23.7	S37 06.6
Y 14	304 43.5	354 39.7	16.1	134 01.6	02.8	276 01.1	25.2	97 55.3	29.6	Sirius	258 34.3	S16 44.1
15	319 46.0	9 39.0	15.3	149 03.4	02.6	291 03.5	25.3	112 57.6	29.7	Spica	158 32.4	S11 13.4
16	334 48.5	24 38.2	14.5	164 05.1	02.4	306 06.0	25.3	127 59.9	29.7	Suhail	222 52.9	S43 28.8
17	349 50.9	39 37.5	13.7	179 06.9	02.2	321 08.4	25.3	143 02.2	29.8			
18	4 53.4	54 36.8	S20 12.9	194 08.7	N 7 01.9	336 10.9	N10 25.3	158 04.5	S 8 29.9	Vega	80 40.1	N38 47.8
19	19 55.9	69 36.1	12.1	209 10.5	01.7	351 13.4	25.3	173 06.8	29.9	Zuben'ubi	137 06.8	S16 05.4
20	34 58.3	84 35.4	11.3	224 12.3	01.5	6 15.8	25.3	188 09.1	30.0		SHA	Mer. Pass.
21	50 00.8	99 34.7	10.6	239 14.1	01.3	21 18.3	25.3	203 11.4	30.0		° ′	h m
22	65 03.3	114 34.0	09.8	254 15.8	01.1	36 20.7	25.4	218 13.7	30.1	Venus	51 57.0	14 20
23	80 05.7	129 33.3	09.0	269 17.6	00.9	51 23.2	25.4	233 16.0	30.1	Mars	189 44.6	5 08
	h m									Jupiter	331 17.3	19 39
Mer. Pass.	17 44.4	v −0.7	d 0.8	v 1.8	d 0.2	v 2.5	d 0.0	v 2.3	d 0.1	Saturn	153 18.3	7 33

SATURDAY SUNDAY MONDAY

UT	SUN			MOON					
	GHA		Dec	GHA	v	Dec	d	HP	
d h	° ′		° ′	° ′	′	° ′	′	′	
24 00	180 12.6		S23 25.5	191 06.7	4.3	S22 29.7	1.1	59.7	
01	195 12.3		25.4	205 30.0	4.4	22 28.6	1.3	59.7	
02	210 12.0		25.4	219 53.4	4.4	22 27.3	1.5	59.7	
03	225 11.7	. .	25.4	234 16.8	4.4	22 25.8	1.6	59.7	
04	240 11.4		25.3	248 40.2	4.4	22 24.2	1.8	59.7	
05	255 11.1		25.3	263 03.6	4.5	22 22.4	1.9	59.6	
06	270 10.7		S23 25.2	277 27.1	4.6	S22 20.5	2.1	59.6	
07	285 10.4		25.2	291 50.7	4.6	22 18.4	2.2	59.6	
S 08	300 10.1		25.2	306 14.3	4.6	22 16.2	2.4	59.6	
A 09	315 09.8	. .	25.1	320 37.9	4.7	22 13.8	2.5	59.6	
T 10	330 09.5		25.1	335 01.6	4.7	22 11.3	2.7	59.5	
U 11	345 09.2		25.0	349 25.3	4.8	22 08.6	2.8	59.5	
R 12	0 08.9		S23 25.0	3 49.1	4.9	S22 05.8	3.0	59.5	
D 13	15 08.6		24.9	18 13.0	4.8	22 02.8	3.1	59.5	
A 14	30 08.2		24.9	32 36.8	5.0	21 59.7	3.3	59.5	
Y 15	45 07.9	. .	24.8	47 00.8	5.0	21 56.4	3.4	59.4	
16	60 07.6		24.8	61 24.8	5.1	21 53.0	3.6	59.4	
17	75 07.3		24.8	75 48.9	5.1	21 49.4	3.7	59.4	
18	90 07.0		S23 24.7	90 13.0	5.2	S21 45.7	3.8	59.4	
19	105 06.7		24.7	104 37.2	5.3	21 41.9	4.0	59.3	
20	120 06.4		24.6	119 01.5	5.3	21 37.9	4.2	59.3	
21	135 06.1	. .	24.6	133 25.8	5.4	21 33.7	4.3	59.3	
22	150 05.8		24.5	147 50.2	5.5	21 29.4	4.4	59.3	
23	165 05.4		24.4	162 14.7	5.5	21 25.0	4.5	59.2	
25 00	180 05.1		S23 24.4	176 39.2	5.6	S21 20.5	4.7	59.2	
01	195 04.8		24.3	191 03.8	5.7	21 15.8	4.9	59.2	
02	210 04.5		24.3	205 28.5	5.8	21 10.9	4.9	59.2	
03	225 04.2	. .	24.2	219 53.3	5.8	21 06.0	5.1	59.1	
04	240 03.9		24.2	234 18.1	5.9	21 00.9	5.3	59.1	
05	255 03.6		24.1	248 43.0	6.0	20 55.6	5.3	59.1	
06	270 03.3		S23 24.0	263 08.0	6.1	S20 50.3	5.5	59.1	
07	285 03.0		24.0	277 33.1	6.1	20 44.8	5.7	59.0	
08	300 02.6		23.9	291 58.2	6.2	20 39.1	5.7	59.0	
S 09	315 02.3	. .	23.9	306 23.4	6.3	20 33.4	5.9	59.0	
U 10	330 02.0		23.8	320 48.7	6.4	20 27.5	6.0	59.0	
N 11	345 01.7		23.7	335 14.1	6.5	20 21.5	6.1	58.9	
D 12	0 01.4		S23 23.7	349 39.6	6.6	S20 15.4	6.3	58.9	
A 13	15 01.1		23.6	4 05.2	6.6	20 09.1	6.4	58.9	
Y 14	30 00.8		23.5	18 30.8	6.8	20 02.7	6.4	58.8	
15	45 00.5	. .	23.5	32 56.6	6.8	19 56.3	6.7	58.8	
16	60 00.2		23.4	47 22.4	6.9	19 49.6	6.7	58.8	
17	74 59.8		23.3	61 48.3	7.0	19 42.9	6.8	58.8	
18	89 59.5		S23 23.3	76 14.3	7.1	S19 36.1	7.0	58.7	
19	104 59.2		23.2	90 40.4	7.2	19 29.1	7.1	58.7	
20	119 58.9		23.1	105 06.6	7.3	19 22.0	7.2	58.7	
21	134 58.6	. .	23.1	119 32.9	7.3	19 14.8	7.3	58.6	
22	149 58.3		23.0	133 59.2	7.5	19 07.5	7.4	58.6	
23	164 58.0		22.9	148 25.7	7.6	19 00.1	7.5	58.6	
26 00	179 57.7		S23 22.8	162 52.3	7.6	S18 52.6	7.6	58.5	
01	194 57.4		22.8	177 18.9	7.7	18 45.0	7.7	58.5	
02	209 57.0		22.7	191 45.6	7.9	18 37.3	7.8	58.5	
03	224 56.7	. .	22.6	206 12.5	7.9	18 29.5	8.0	58.5	
04	239 56.4		22.5	220 39.4	8.0	18 21.5	8.0	58.4	
05	254 56.1		22.5	235 06.4	8.1	18 13.5	8.1	58.4	
06	269 55.8		S23 22.4	249 33.5	8.3	S18 05.4	8.2	58.4	
07	284 55.5		22.3	264 00.8	8.3	17 57.2	8.4	58.3	
08	299 55.2		22.2	278 28.1	8.4	17 48.8	8.4	58.3	
M 09	314 54.9	. .	22.1	292 55.5	8.5	17 40.4	8.5	58.3	
O 10	329 54.6		22.1	307 23.0	8.6	17 31.9	8.6	58.2	
N 11	344 54.3		22.0	321 50.6	8.7	17 23.3	8.7	58.2	
D 12	359 53.9		S23 21.9	336 18.3	8.7	S17 14.6	8.8	58.2	
A 13	14 53.6		21.8	350 46.0	8.9	17 05.8	8.8	58.1	
Y 14	29 53.3		21.7	5 13.9	9.0	16 57.0	9.0	58.1	
15	44 53.0	. .	21.6	19 41.9	9.1	16 48.0	9.0	58.1	
16	59 52.7		21.6	34 10.0	9.1	16 39.0	9.1	58.0	
17	74 52.4		21.5	48 38.1	9.3	16 29.9	9.2	58.0	
18	89 52.1		S23 21.4	63 06.4	9.4	S16 20.7	9.3	58.0	
19	104 51.8		21.3	77 34.8	9.4	16 11.4	9.4	57.9	
20	119 51.5		21.2	92 03.2	9.6	16 02.0	9.4	57.9	
21	134 51.2	. .	21.1	106 31.8	9.6	15 52.6	9.5	57.9	
22	149 50.8		21.0	121 00.4	9.7	15 43.1	9.6	57.8	
23	164 50.5		20.9	135 29.1	9.9	S15 33.5	9.7	57.8	
	SD 16.3		d 0.1	SD 16.2		16.0		15.8	

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 24	Moonrise 25	Moonrise 26	Moonrise 27
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 27	10 57	▬	▬	▬	12 30	11 36
N 70	08 07	09 55	▬	▬	▬	11 33	11 10
68	07 51	09 20	▬	▬	11 10	10 58	10 51
66	07 38	08 55	10 35	10 10	10 27	10 33	10 35
64	07 27	08 35	09 53	09 29	09 59	10 14	10 22
62	07 17	08 19	09 25	09 01	09 36	09 58	10 11
60	07 09	08 06	09 03	08 39	09 19	09 44	10 02
N 58	07 01	07 54	08 46	08 21	09 04	09 33	09 54
56	06 54	07 44	08 31	08 06	08 51	09 23	09 46
54	06 48	07 35	08 18	07 53	08 39	09 14	09 40
52	06 43	07 26	08 07	07 42	08 29	09 06	09 34
50	06 37	07 19	07 57	07 32	08 21	08 59	09 29
45	06 26	07 03	07 37	07 11	08 02	08 43	09 17
N 40	06 15	06 49	07 20	06 54	07 46	08 30	09 07
35	06 06	06 38	07 06	06 39	07 33	08 19	08 59
30	05 57	06 27	06 53	06 27	07 22	08 10	08 52
20	05 41	06 08	06 32	06 06	07 02	07 53	08 39
N 10	05 24	05 51	06 14	05 47	06 45	07 39	08 28
0	05 07	05 34	05 56	05 30	06 29	07 25	08 18
S 10	04 48	05 15	05 39	05 12	06 13	07 12	08 07
20	04 26	04 55	05 20	04 54	05 56	06 57	07 56
30	03 57	04 30	04 58	04 32	05 36	06 41	07 43
35	03 38	04 15	04 45	04 20	05 25	06 31	07 36
40	03 15	03 57	04 29	04 06	05 12	06 20	07 27
45	02 44	03 34	04 11	03 49	04 56	06 07	07 17
S 50	01 59	03 04	03 49	03 27	04 37	05 51	07 05
52	01 31	02 49	03 38	03 17	04 28	05 43	07 00
54	00 44	02 31	03 26	03 06	04 17	05 35	06 53
56	////	02 09	03 11	02 53	04 06	05 25	06 46
58	////	01 39	02 55	02 38	03 52	05 15	06 39
S 60	////	00 48	02 34	02 20	03 36	05 02	06 30

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 24	Moonset 25	Moonset 26	Moonset 27
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 03	15 33	▬	▬	15 03	17 44
N 70	▬	14 05	15 53	▬	▬	15 59	18 08
68	▬	14 40	16 09	▬	14 26	16 33	18 26
66	13 25	15 05	16 22	13 23	15 08	16 57	18 40
64	14 07	15 25	16 33	14 03	15 36	17 15	18 52
62	14 35	15 41	16 43	14 31	15 58	17 30	19 02
60	14 57	15 54	16 51	14 53	16 15	17 43	19 10
N 58	15 14	16 06	16 59	15 10	16 30	17 54	19 18
56	15 29	16 16	17 05	15 25	16 42	18 04	19 24
54	15 41	16 25	17 12	15 38	16 53	18 12	19 30
52	15 53	16 33	17 17	15 49	17 03	18 19	19 35
50	16 02	16 41	17 22	15 59	17 11	18 26	19 40
45	16 23	16 57	17 34	16 19	17 29	18 40	19 50
N 40	16 40	17 11	17 45	16 36	17 44	18 52	19 59
35	16 54	17 22	17 54	16 50	17 56	19 02	20 06
30	17 06	17 33	18 03	17 03	18 07	19 11	20 12
20	17 28	17 52	18 19	17 23	18 26	19 26	20 23
N 10	17 46	18 09	18 35	17 42	18 42	19 39	20 32
0	18 04	18 26	18 52	17 58	18 57	19 51	20 41
S 10	18 21	18 44	19 11	18 15	19 11	20 03	20 50
20	18 40	19 05	19 34	18 33	19 27	20 16	20 59
30	19 02	19 30	20 03	18 54	19 45	20 30	21 10
35	19 15	19 45	20 22	19 06	19 56	20 39	21 16
40	19 30	20 03	20 45	19 19	20 08	20 48	21 22
45	19 48	20 26	21 15	19 36	20 22	20 59	21 30
S 50	20 11	20 55	22 01	19 55	20 39	21 12	21 40
52	20 22	21 10	22 29	20 05	20 47	21 19	21 44
54	20 34	21 28	23 15	20 15	20 55	21 25	21 49
56	20 48	21 51	////	20 27	21 05	21 33	21 54
58	21 05	22 20	////	20 41	21 17	21 42	22 00
S 60	21 25	23 10	////	20 57	21 30	21 51	22 07

Day	SUN Eqn. of Time 00^h	SUN Eqn. of Time 12^h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
24	00 51	00 36	11 59	11 44	24 14	29	0
25	00 21	00 06	12 00	12 43	00 14	01	1
26	00 09	00 24	12 00	13 38	01 11	02	4

UT	ARIES	VENUS −3.9		MARS +0.3		JUPITER −2.6		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
27 00	95 08.2	144 32.6	S20 08.2	284 19.4	N 7 00.6	66 25.7	N10 25.4	248 18.3	S 8 30.2
01	110 10.6	159 31.9	07.4	299 21.2	00.4	81 28.1	25.4	263 20.6	30.2
02	125 13.1	174 31.2	06.6	314 23.0	00.2	96 30.6	25.4	278 22.8	30.3
03	140 15.6	189 30.5	05.8	329 24.8	7 00.0	111 33.0	25.4	293 25.1	30.3
04	155 18.0	204 29.8	05.0	344 26.6	6 59.8	126 35.5	25.4	308 27.4	30.4
05	170 20.5	219 29.1	04.2	359 28.4	59.6	141 38.0	25.5	323 29.7	30.4
06	185 23.0	234 28.5	S20 03.4	14 30.1	N 6 59.4	156 40.4	N10 25.5	338 32.0	S 8 30.5
07	200 25.4	249 27.8	02.6	29 31.9	59.1	171 42.9	25.5	353 34.3	30.5
08	215 27.9	264 27.1	01.8	44 33.7	58.9	186 45.3	25.5	8 36.6	30.6
09	230 30.4	279 26.4	01.0	59 35.5	58.7	201 47.8	25.5	23 38.9	30.7
10	245 32.8	294 25.7	20 00.2	74 37.3	58.5	216 50.2	25.5	38 41.2	30.7
11	260 35.3	309 25.0	19 59.4	89 39.1	58.3	231 52.7	25.6	53 43.5	30.8
12	275 37.7	324 24.3	S19 58.5	104 40.9	N 6 58.1	246 55.2	N10 25.6	68 45.8	S 8 30.8
13	290 40.2	339 23.6	57.7	119 42.7	57.9	261 57.6	25.6	83 48.1	30.9
14	305 42.7	354 22.9	56.9	134 44.5	57.7	277 00.1	25.6	98 50.4	30.9
15	320 45.1	9 22.2	56.1	149 46.3	57.4	292 02.5	25.6	113 52.7	31.0
16	335 47.6	24 21.5	55.3	164 48.1	57.2	307 05.0	25.6	128 55.0	31.0
17	350 50.1	39 20.8	54.5	179 49.9	57.0	322 07.4	25.7	143 57.3	31.1
18	5 52.5	54 20.2	S19 53.7	194 51.7	N 6 56.8	337 09.9	N10 25.7	158 59.6	S 8 31.1
19	20 55.0	69 19.5	52.9	209 53.5	56.6	352 12.3	25.7	174 01.9	31.2
20	35 57.5	84 18.8	52.1	224 55.3	56.4	7 14.8	25.7	189 04.2	31.2
21	50 59.9	99 18.1	51.2	239 57.1	56.2	22 17.2	25.7	204 06.5	31.3
22	66 02.4	114 17.4	50.4	254 58.9	56.0	37 19.7	25.8	219 08.8	31.3
23	81 04.9	129 16.7	49.6	270 00.7	55.8	52 22.2	25.8	234 11.1	31.4
28 00	96 07.3	144 16.0	S19 48.8	285 02.5	N 6 55.6	67 24.6	N10 25.8	249 13.4	S 8 31.4
01	111 09.8	159 15.4	48.0	300 04.3	55.4	82 27.1	25.8	264 15.7	31.5
02	126 12.2	174 14.7	47.1	315 06.1	55.1	97 29.5	25.8	279 18.0	31.5
03	141 14.7	189 14.0	46.3	330 07.9	54.9	112 32.0	25.8	294 20.3	31.6
04	156 17.2	204 13.3	45.5	345 09.7	54.7	127 34.4	25.9	309 22.6	31.6
05	171 19.6	219 12.6	44.7	0 11.5	54.5	142 36.9	25.9	324 24.9	31.7
06	186 22.1	234 11.9	S19 43.9	15 13.3	N 6 54.3	157 39.3	N10 25.9	339 27.2	S 8 31.8
07	201 24.6	249 11.3	43.0	30 15.1	54.1	172 41.8	25.9	354 29.5	31.8
08	216 27.0	264 10.6	42.2	45 17.0	53.9	187 44.2	25.9	9 31.8	31.9
09	231 29.5	279 09.9	41.4	60 18.8	53.7	202 46.7	26.0	24 34.1	31.9
10	246 32.0	294 09.2	40.5	75 20.6	53.5	217 49.1	26.0	39 36.4	32.0
11	261 34.4	309 08.6	39.7	90 22.4	53.3	232 51.5	26.0	54 38.7	32.0
12	276 36.9	324 07.9	S19 38.9	105 24.2	N 6 53.1	247 54.0	N10 26.0	69 41.0	S 8 32.1
13	291 39.4	339 07.2	38.1	120 26.0	52.9	262 56.4	26.0	84 43.3	32.1
14	306 41.8	354 06.5	37.2	135 27.8	52.7	277 58.9	26.1	99 45.6	32.2
15	321 44.3	9 05.8	36.4	150 29.6	52.5	293 01.3	26.1	114 47.9	32.2
16	336 46.7	24 05.2	35.6	165 31.5	52.3	308 03.8	26.1	129 50.2	32.3
17	351 49.2	39 04.5	34.7	180 33.3	52.1	323 06.2	26.1	144 52.5	32.3
18	6 51.7	54 03.8	S19 33.9	195 35.1	N 6 51.9	338 08.7	N10 26.1	159 54.8	S 8 32.4
19	21 54.1	69 03.2	33.0	210 36.9	51.7	353 11.1	26.2	174 57.1	32.4
20	36 56.6	84 02.5	32.2	225 38.7	51.5	8 13.6	26.2	189 59.4	32.5
21	51 59.1	99 01.8	31.4	240 40.6	51.3	23 16.0	26.2	205 01.7	32.5
22	67 01.5	114 01.1	30.5	255 42.4	51.1	38 18.5	26.2	220 04.0	32.6
23	82 04.0	129 00.5	29.7	270 44.2	50.9	53 20.9	26.3	235 06.3	32.6
29 00	97 06.5	143 59.8	S19 28.8	285 46.0	N 6 50.7	68 23.3	N10 26.3	250 08.6	S 8 32.7
01	112 08.9	158 59.1	28.0	300 47.8	50.5	83 25.8	26.3	265 10.9	32.7
02	127 11.4	173 58.5	27.2	315 49.7	50.3	98 28.2	26.3	280 13.2	32.8
03	142 13.8	188 57.8	26.3	330 51.5	50.1	113 30.7	26.3	295 15.5	32.8
04	157 16.3	203 57.1	25.5	345 53.3	49.9	128 33.1	26.4	310 17.8	32.9
05	172 18.8	218 56.5	24.6	0 55.1	49.7	143 35.5	26.4	325 20.1	32.9
06	187 21.2	233 55.8	S19 23.8	15 57.0	N 6 49.5	158 38.0	N10 26.4	340 22.4	S 8 33.0
07	202 23.7	248 55.1	22.9	30 58.8	49.3	173 40.4	26.4	355 24.7	33.0
08	217 26.2	263 54.5	22.1	46 00.6	49.1	188 42.9	26.5	10 27.0	33.1
09	232 28.6	278 53.8	21.2	61 02.4	48.9	203 45.3	26.5	25 29.3	33.1
10	247 31.1	293 53.1	20.4	76 04.3	48.7	218 47.8	26.5	40 31.6	33.2
11	262 33.6	308 52.5	19.5	91 06.1	48.5	233 50.2	26.5	55 33.9	33.2
12	277 36.0	323 51.8	S19 18.7	106 07.9	N 6 48.3	248 52.6	N10 26.5	70 36.2	S 8 33.3
13	292 38.5	338 51.2	17.8	121 09.8	48.1	263 55.1	26.6	85 38.5	33.3
14	307 41.0	353 50.5	17.0	136 11.6	47.9	278 57.5	26.6	100 40.8	33.4
15	322 43.4	8 49.8	16.1	151 13.4	47.7	293 59.9	26.6	115 43.1	33.4
16	337 45.9	23 49.2	15.3	166 15.3	47.5	309 02.4	26.6	130 45.4	33.5
17	352 48.3	38 48.5	14.4	181 17.1	47.3	324 04.8	26.7	145 47.7	33.5
18	7 50.8	53 47.9	S19 13.5	196 18.9	N 6 47.1	339 07.3	N10 26.7	160 50.0	S 8 33.6
19	22 53.3	68 47.2	12.7	211 20.8	46.9	354 09.7	26.7	175 52.4	33.6
20	37 55.7	83 46.5	11.8	226 22.6	46.7	9 12.1	26.7	190 54.7	33.7
21	52 58.2	98 45.9	11.0	241 24.5	46.6	24 14.6	26.8	205 57.0	33.7
22	68 00.7	113 45.2	10.1	256 26.3	46.4	39 17.0	26.8	220 59.3	33.8
23	83 03.1	128 44.6	09.2	271 28.1	46.2	54 19.4	26.8	236 01.6	33.8
	h m								
Mer. Pass.	17 32.6	v −0.7	d 0.8	v 1.8	d 0.2	v 2.4	d 0.0	v 2.3	d 0.1

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.6
Achernar	335 27.3	S57 10.8
Acrux	173 10.5	S63 09.7
Adhara	255 12.9	S28 59.4
Aldebaran	290 50.2	N16 32.0
Alioth	166 21.6	N55 53.3
Alkaid	152 59.9	N49 14.9
Al Na'ir	27 45.3	S46 54.2
Alnilam	275 47.1	S 1 11.8
Alphard	217 56.9	S 8 42.8
Alphecca	126 12.1	N26 40.4
Alpheratz	357 44.6	N29 09.7
Altair	62 09.6	N 8 54.1
Ankaa	353 16.7	S42 14.6
Antares	112 27.8	S26 27.4
Arcturus	145 56.8	N19 07.0
Atria	107 31.1	S69 02.7
Avior	234 17.9	S59 32.9
Bellatrix	278 32.8	N 6 21.5
Betelgeuse	271 02.1	N 7 24.4
Canopus	263 56.0	S52 42.2
Capella	280 35.5	N46 00.6
Deneb	49 32.6	N45 19.7
Denebola	182 34.6	N14 30.1
Diphda	348 56.9	S17 55.3
Dubhe	193 52.7	N61 40.8
Elnath	278 13.5	N28 37.0
Eltanin	90 47.2	N51 29.3
Enif	33 48.3	N 9 56.0
Fomalhaut	15 25.2	S29 33.6
Gacrux	172 02.1	S57 10.6
Gienah	175 53.3	S17 36.5
Hadar	148 49.7	S60 25.6
Hamal	328 01.7	N23 31.3
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 20.7	N74 06.1
Markab	13 39.5	N15 16.4
Menkar	314 15.9	N 4 08.2
Menkent	148 09.0	S36 25.6
Miaplacidus	221 39.2	S69 45.9
Mirfak	308 41.4	N49 54.4
Nunki	76 00.0	S26 16.8
Peacock	53 21.4	S56 41.8
Pollux	243 28.6	N27 59.6
Procyon	245 00.5	N 5 11.5
Rasalhague	96 07.7	N12 33.1
Regulus	207 44.4	N11 54.3
Rigel	281 12.7	S 8 11.4
Rigil Kent.	139 53.5	S60 52.8
Sabik	102 14.0	S15 44.3
Schedar	349 41.7	N56 36.6
Shaula	96 23.7	S37 06.6
Sirius	258 34.3	S16 44.1
Spica	158 32.4	S11 13.5
Suhail	222 52.9	S43 28.9
Vega	80 40.1	N38 47.8
Zuben'ubi	137 06.8	S16 05.4

	SHA	Mer. Pass.
	° ′	h m
Venus	48 08.7	14 24
Mars	188 55.2	4 59
Jupiter	331 17.3	19 27
Saturn	153 06.1	7 22

T U E S D A Y

W E D N E S D A Y

T H U R S D A Y

UT	SUN		MOON					
	GHA	Dec	GHA	v	Dec	d	HP	
d h	° ′	° ′	° ′	′	° ′	′	′	
27 00	179 50.2	S23 20.8	149 58.0	9.9	S15 23.8	9.7	57.8	
01	194 49.9	20.7	164 26.9	10.0	15 14.1	9.8	57.7	
02	209 49.6	20.6	178 55.9	10.1	15 04.3	9.9	57.7	
03	224 49.3	20.6	193 25.0	10.2	14 54.4	9.9	57.7	
04	239 49.0	20.5	207 54.2	10.3	14 44.5	10.1	57.6	
05	254 48.7	20.4	222 23.5	10.4	14 34.4	10.0	57.6	
06	269 48.4	S23 20.3	236 52.9	10.5	S14 24.4	10.2	57.6	
07	284 48.1	20.2	251 22.4	10.6	14 14.2	10.2	57.5	
T 08	299 47.8	20.1	265 52.0	10.6	14 04.0	10.2	57.5	
U 09	314 47.4	20.0	280 21.6	10.8	13 53.8	10.3	57.5	
E 10	329 47.1	19.9	294 51.4	10.8	13 43.5	10.4	57.4	
S 11	344 46.8	19.8	309 21.2	10.9	13 33.1	10.5	57.4	
D 12	359 46.5	S23 19.7	323 51.1	11.0	S13 22.6	10.5	57.4	
A 13	14 46.2	19.6	338 21.1	11.1	13 12.1	10.5	57.3	
Y 14	29 45.9	19.4	352 51.2	11.2	13 01.6	10.6	57.3	
15	44 45.6	19.3	7 21.4	11.3	12 51.0	10.6	57.3	
16	59 45.3	19.2	21 51.7	11.4	12 40.4	10.8	57.2	
17	74 45.0	19.1	36 22.1	11.4	12 29.6	10.7	57.2	
18	89 44.7	S23 19.0	50 52.5	11.6	S12 18.9	10.8	57.2	
19	104 44.4	18.9	65 23.1	11.6	12 08.1	10.8	57.1	
20	119 44.0	18.8	79 53.7	11.7	11 57.3	10.9	57.1	
21	134 43.7	18.7	94 24.4	11.7	11 46.4	11.0	57.1	
22	149 43.4	18.6	108 55.1	11.9	11 35.4	11.0	57.0	
23	164 43.1	18.5	123 26.0	11.9	11 24.4	11.0	57.0	
28 00	179 42.8	S23 18.4	137 56.9	12.1	S11 13.4	11.0	57.0	
01	194 42.5	18.2	152 28.0	12.1	11 02.4	11.1	56.9	
02	209 42.2	18.1	166 59.1	12.2	10 51.3	11.2	56.9	
03	224 41.9	18.0	181 30.3	12.2	10 40.1	11.2	56.9	
04	239 41.6	17.9	196 01.5	12.3	10 28.9	11.2	56.8	
05	254 41.3	17.8	210 32.8	12.5	10 17.7	11.2	56.8	
06	269 41.0	S23 17.7	225 04.3	12.4	S10 06.5	11.3	56.8	
W 07	284 40.7	17.5	239 35.7	12.6	9 55.2	11.3	56.7	
E 08	299 40.4	17.4	254 07.3	12.6	9 43.9	11.4	56.7	
D 09	314 40.1	17.3	268 38.9	12.8	9 32.5	11.3	56.7	
N 10	329 39.7	17.2	283 10.7	12.7	9 21.2	11.4	56.6	
E 11	344 39.4	17.1	297 42.4	12.9	9 09.8	11.5	56.6	
S 12	359 39.1	S23 16.9	312 14.3	12.9	S 8 58.3	11.5	56.6	
D 13	14 38.8	16.8	326 46.2	13.0	8 46.8	11.4	56.5	
A 14	29 38.5	16.7	341 18.2	13.1	8 35.4	11.6	56.5	
Y 15	44 38.2	16.6	355 50.3	13.1	8 23.8	11.5	56.5	
16	59 37.9	16.4	10 22.4	13.2	8 12.3	11.6	56.4	
17	74 37.6	16.3	24 54.6	13.2	8 00.7	11.5	56.4	
18	89 37.3	S23 16.2	39 26.8	13.4	S 7 49.2	11.7	56.4	
19	104 37.0	16.1	53 59.2	13.3	7 37.5	11.6	56.3	
20	119 36.7	15.9	68 31.5	13.5	7 25.9	11.6	56.3	
21	134 36.4	15.8	83 04.0	13.5	7 14.3	11.7	56.3	
22	149 36.1	15.7	97 36.5	13.6	7 02.6	11.7	56.2	
23	164 35.8	15.5	112 09.1	13.6	6 50.9	11.7	56.2	
29 00	179 35.5	S23 15.4	126 41.7	13.7	S 6 39.2	11.7	56.2	
01	194 35.1	15.3	141 14.4	13.8	6 27.5	11.7	56.1	
02	209 34.8	15.1	155 47.2	13.8	6 15.8	11.8	56.1	
03	224 34.5	15.0	170 20.0	13.8	6 04.0	11.7	56.1	
04	239 34.2	14.9	184 52.8	13.9	5 52.3	11.8	56.0	
05	254 33.9	14.7	199 25.7	14.0	5 40.5	11.8	56.0	
06	269 33.6	S23 14.6	213 58.7	14.1	S 5 28.7	11.8	56.0	
07	284 33.3	14.5	228 31.8	14.0	5 16.9	11.8	56.0	
T 08	299 33.0	14.3	243 04.8	14.2	5 05.1	11.8	55.9	
H 09	314 32.7	14.2	257 38.0	14.1	4 53.3	11.8	55.9	
U 10	329 32.4	14.0	272 11.1	14.3	4 41.5	11.8	55.9	
R 11	344 32.1	13.9	286 44.4	14.3	4 29.7	11.8	55.8	
S 12	359 31.8	S23 13.8	301 17.7	14.3	S 4 17.9	11.9	55.8	
D 13	14 31.5	13.6	315 51.0	14.4	4 06.0	11.8	55.8	
A 14	29 31.2	13.5	330 24.4	14.4	3 54.2	11.9	55.7	
Y 15	44 30.9	13.3	344 57.8	14.5	3 42.3	11.8	55.7	
16	59 30.6	13.2	359 31.3	14.5	3 30.5	11.8	55.7	
17	74 30.3	13.0	14 04.8	14.5	3 18.7	11.9	55.7	
18	89 30.0	S23 12.9	28 38.3	14.6	S 3 06.8	11.8	55.6	
19	104 29.7	12.7	43 11.9	14.7	2 55.0	11.9	55.6	
20	119 29.4	12.6	57 45.6	14.6	2 43.1	11.8	55.6	
21	134 29.1	12.4	72 19.2	14.7	2 31.3	11.9	55.6	
22	149 28.8	12.3	86 52.9	14.8	2 19.4	11.8	55.5	
23	164 28.4	12.1	101 26.7	14.8	S 2 07.6	11.9	55.5	
	SD 16.3	d 0.1	SD	15.6		15.4		15.2

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 27	Moonrise 28	Moonrise 29	Moonrise 30
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 27	10 53		11 36	11 10	10 51	10 34
N 70	08 07	09 54		11 10	10 56	10 44	10 34
68	07 51	09 20		10 51	10 45	10 39	10 34
66	07 38	08 55	10 34	10 35	10 35	10 35	10 34
64	07 27	08 35	09 53	10 22	10 27	10 31	10 34
62	07 18	08 20	09 25	10 11	10 21	10 28	10 34
60	07 09	08 06	09 04	10 02	10 15	10 25	10 34
N 58	07 02	07 55	08 46	09 54	10 09	10 22	10 34
56	06 55	07 44	08 32	09 46	10 05	10 20	10 34
54	06 49	07 35	08 19	09 40	10 01	10 18	10 34
52	06 44	07 27	08 08	09 34	09 57	10 16	10 34
50	06 38	07 20	07 58	09 29	09 53	10 15	10 34
45	06 27	07 04	07 38	09 17	09 46	10 11	10 34
N 40	06 16	06 50	07 21	09 07	09 39	10 08	10 34
35	06 07	06 39	07 07	08 59	09 34	10 05	10 34
30	05 58	06 28	06 55	08 52	09 29	10 03	10 34
20	05 42	06 09	06 33	08 39	09 20	09 59	10 35
N 10	05 26	05 52	06 15	08 28	09 13	09 55	10 35
0	05 09	05 35	05 58	08 18	09 06	09 51	10 35
S 10	04 50	05 17	05 40	08 07	08 59	09 48	10 35
20	04 28	04 57	05 21	07 56	08 52	09 44	10 35
30	03 59	04 32	04 59	07 43	08 43	09 40	10 35
35	03 40	04 17	04 46	07 36	08 38	09 38	10 35
40	03 17	03 59	04 31	07 27	08 32	09 35	10 35
45	02 47	03 36	04 13	07 17	08 26	09 32	10 36
S 50	02 01	03 07	03 51	07 05	08 18	09 28	10 36
52	01 34	02 52	03 40	07 00	08 14	09 26	10 36
54	00 49	02 34	03 28	06 53	08 10	09 24	10 36
56	////	02 12	03 14	06 46	08 06	09 22	10 36
58	////	01 42	02 57	06 39	08 01	09 20	10 36
S 60	////	00 54	02 37	06 30	07 55	09 17	10 36

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 27	Moonset 28	Moonset 29	Moonset 30
°	h m	h m	h m	h m	h m	h m	h m
N 72		13 10	15 36	17 44	19 49	21 41	23 28
N 70		14 09	15 56	18 08	20 00	21 45	23 24
68		14 43	16 12	18 26	20 10	21 47	23 21
66	13 29	15 08	16 25	18 40	20 18	21 50	23 19
64	14 10	15 27	16 36	18 52	20 24	21 52	23 17
62	14 38	15 43	16 45	19 02	20 30	21 54	23 15
60	14 59	15 57	16 54	19 10	20 35	21 55	23 13
N 58	15 17	16 08	17 01	19 18	20 39	21 57	23 12
56	15 31	16 19	17 08	19 24	20 43	21 58	23 11
54	15 44	16 28	17 14	19 30	20 46	21 59	23 10
52	15 55	16 36	17 19	19 35	20 49	22 00	23 09
50	16 05	16 43	17 25	19 40	20 52	22 01	23 08
45	16 25	16 59	17 36	19 50	20 58	22 03	23 06
N 40	16 42	17 12	17 46	19 59	21 03	22 04	23 04
35	16 56	17 24	17 56	20 06	21 07	22 06	23 02
30	17 08	17 35	18 04	20 12	21 11	22 07	23 01
20	17 29	17 53	18 21	20 23	21 17	22 09	22 59
N 10	17 48	18 11	18 37	20 32	21 23	22 11	22 57
0	18 05	18 28	18 54	20 41	21 28	22 12	22 55
S 10	18 23	18 46	19 13	20 50	21 33	22 14	22 53
20	18 41	19 06	19 35	20 59	21 39	22 16	22 51
30	19 03	19 31	20 04	21 10	21 45	22 18	22 49
35	19 16	19 46	20 23	21 16	21 49	22 19	22 48
40	19 31	20 04	20 46	21 22	21 53	22 20	22 46
45	19 49	20 26	21 16	21 30	21 57	22 22	22 45
S 50	20 11	20 56	22 01	21 40	22 03	22 23	22 43
52	20 22	21 11	22 28	21 44	22 05	22 24	22 42
54	20 34	21 29	23 12	21 49	22 08	22 25	22 41
56	20 49	21 50	////	21 54	22 11	22 26	22 39
58	21 05	22 20	////	22 00	22 14	22 27	22 38
S 60	21 25	23 07	////	22 07	22 18	22 28	22 37

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
27	00 38	00 53	12 01	14 30	02 04	03	9
28	01 08	01 23	12 01	15 17	02 54	04	16
29	01 38	01 52	12 02	16 02	03 40	05	25

UT	ARIES	VENUS −3.9		MARS +0.2		JUPITER −2.6		SATURN +0.7	
	GHA	GHA	Dec	GHA	Dec	GHA	Dec	GHA	Dec
d h	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
30 00	98 05.6	143 43.9	S19 08.4	286 30.0	N 6 46.0	69 21.9	N10 26.8	251 03.9	S 8 33.9
01	113 08.1	158 43.3	07.5	301 31.8	45.8	84 24.3	26.9	266 06.2	33.9
02	128 10.5	173 42.6	06.6	316 33.7	45.6	99 26.7	26.9	281 08.5	34.0
03	143 13.0	188 42.0	05.8	331 35.5	45.4	114 29.2	26.9	296 10.8	34.0
04	158 15.5	203 41.3	04.9	346 37.3	45.2	129 31.6	26.9	311 13.1	34.1
05	173 17.9	218 40.7	04.0	1 39.2	45.0	144 34.0	27.0	326 15.4	34.1
06	188 20.4	233 40.0	S19 03.2	16 41.0	N 6 44.8	159 36.5	N10 27.0	341 17.7	S 8 34.2
07	203 22.8	248 39.4	02.3	31 42.9	44.6	174 38.9	27.0	356 20.0	34.2
08	218 25.3	263 38.7	01.4	46 44.7	44.5	189 41.3	27.0	11 22.3	34.3
F 09	233 27.8	278 38.1	19 00.6	61 46.6	44.3	204 43.8	27.1	26 24.6	34.3
R 10	248 30.2	293 37.4	18 59.7	76 48.4	44.1	219 46.2	27.1	41 26.9	34.4
I 11	263 32.7	308 36.8	58.8	91 50.3	43.9	234 48.6	27.1	56 29.2	34.4
D 12	278 35.2	323 36.1	S18 57.9	106 52.1	N 6 43.7	249 51.1	N10 27.1	71 31.5	S 8 34.5
A 13	293 37.6	338 35.5	57.1	121 54.0	43.5	264 53.5	27.2	86 33.9	34.5
Y 14	308 40.1	353 34.8	56.2	136 55.8	43.3	279 55.9	27.2	101 36.2	34.6
15	323 42.6	8 34.2	55.3	151 57.7	43.1	294 58.4	27.2	116 38.5	34.6
16	338 45.0	23 33.5	54.4	166 59.5	43.0	310 00.8	27.2	131 40.8	34.7
17	353 47.5	38 32.9	53.5	182 01.4	42.8	325 03.2	27.3	146 43.1	34.7
18	8 49.9	53 32.3	S18 52.7	197 03.2	N 6 42.6	340 05.6	N10 27.3	161 45.4	S 8 34.7
19	23 52.4	68 31.6	51.8	212 05.1	42.4	355 08.1	27.3	176 47.7	34.8
20	38 54.9	83 31.0	50.9	227 06.9	42.2	10 10.5	27.3	191 50.0	34.8
21	53 57.3	98 30.3	50.0	242 08.8	42.0	25 12.9	27.4	206 52.3	34.9
22	68 59.8	113 29.7	49.1	257 10.7	41.8	40 15.4	27.4	221 54.6	34.9
23	84 02.3	128 29.0	48.3	272 12.5	41.7	55 17.8	27.4	236 56.9	35.0
31 00	99 04.7	143 28.4	S18 47.4	287 14.4	N 6 41.5	70 20.2	N10 27.5	251 59.2	S 8 35.0
01	114 07.2	158 27.8	46.5	302 16.2	41.3	85 22.6	27.5	267 01.5	35.1
02	129 09.7	173 27.1	45.6	317 18.1	41.1	100 25.1	27.5	282 03.9	35.1
03	144 12.1	188 26.5	44.7	332 20.0	40.9	115 27.5	27.5	297 06.2	35.2
04	159 14.6	203 25.9	43.8	347 21.8	40.7	130 29.9	27.6	312 08.5	35.2
05	174 17.1	218 25.2	42.9	2 23.7	40.6	145 32.3	27.6	327 10.8	35.3
06	189 19.5	233 24.6	S18 42.0	17 25.5	N 6 40.4	160 34.8	N10 27.6	342 13.1	S 8 35.3
07	204 22.0	248 23.9	41.1	32 27.4	40.2	175 37.2	27.7	357 15.4	35.4
S 08	219 24.4	263 23.3	40.3	47 29.3	40.0	190 39.6	27.7	12 17.7	35.4
A 09	234 26.9	278 22.7	39.4	62 31.1	39.8	205 42.0	27.7	27 20.0	35.5
T 10	249 29.4	293 22.0	38.5	77 33.0	39.7	220 44.5	27.7	42 22.3	35.5
U 11	264 31.8	308 21.4	37.6	92 34.9	39.5	235 46.9	27.8	57 24.6	35.6
R 12	279 34.3	323 20.8	S18 36.7	107 36.7	N 6 39.3	250 49.3	N10 27.8	72 27.0	S 8 35.6
D 13	294 36.8	338 20.2	35.8	122 38.6	39.1	265 51.7	27.8	87 29.3	35.7
A 14	309 39.2	353 19.5	34.9	137 40.5	38.9	280 54.1	27.9	102 31.6	35.7
Y 15	324 41.7	8 18.9	34.0	152 42.4	38.8	295 56.6	27.9	117 33.9	35.7
16	339 44.2	23 18.3	33.1	167 44.2	38.6	310 59.0	27.9	132 36.2	35.8
17	354 46.6	38 17.6	32.2	182 46.1	38.4	326 01.4	27.9	147 38.5	35.8
18	9 49.1	53 17.0	S18 31.3	197 48.0	N 6 38.2	341 03.8	N10 28.0	162 40.8	S 8 35.9
19	24 51.6	68 16.4	30.4	212 49.8	38.1	356 06.3	28.0	177 43.1	35.9
20	39 54.0	83 15.8	29.5	227 51.7	37.9	11 08.7	28.0	192 45.4	36.0
21	54 56.5	98 15.1	28.6	242 53.6	37.7	26 11.1	28.1	207 47.8	36.0
22	69 58.9	113 14.5	27.7	257 55.5	37.5	41 13.5	28.1	222 50.1	36.1
23	85 01.4	128 13.9	26.8	272 57.4	37.4	56 15.9	28.1	237 52.4	36.1
1 00	100 03.9	143 13.3	S18 25.9	287 59.2	N 6 37.2	71 18.3	N10 28.2	252 54.7	S 8 36.2
01	115 06.3	158 12.6	24.9	303 01.1	37.0	86 20.8	28.2	267 57.0	36.2
02	130 08.8	173 12.0	24.0	318 03.0	36.8	101 23.2	28.2	282 59.3	36.3
03	145 11.3	188 11.4	23.1	333 04.9	36.7	116 25.6	28.2	298 01.6	36.3
04	160 13.7	203 10.8	22.2	348 06.8	36.5	131 28.0	28.3	313 03.9	36.4
05	175 16.2	218 10.1	21.3	3 08.6	36.3	146 30.4	28.3	328 06.3	36.4
06	190 18.7	233 09.5	S18 20.4	18 10.5	N 6 36.1	161 32.8	N10 28.3	343 08.6	S 8 36.4
07	205 21.1	248 08.9	19.5	33 12.4	36.0	176 35.3	28.4	358 10.9	36.5
08	220 23.6	263 08.3	18.6	48 14.3	35.8	191 37.7	28.4	13 13.2	36.5
S 09	235 26.0	278 07.7	17.7	63 16.2	35.6	206 40.1	28.4	28 15.5	36.6
U 10	250 28.5	293 07.1	16.7	78 18.1	35.4	221 42.5	28.5	43 17.8	36.6
N 11	265 31.0	308 06.4	15.8	93 19.9	35.3	236 44.9	28.5	58 20.1	36.7
D 12	280 33.4	323 05.8	S18 14.9	108 21.8	N 6 35.1	251 47.3	N10 28.5	73 22.4	S 8 36.7
A 13	295 35.9	338 05.2	14.0	123 23.7	34.9	266 49.8	28.6	88 24.8	36.8
Y 14	310 38.4	353 04.6	13.1	138 25.6	34.8	281 52.2	28.6	103 27.1	36.8
15	325 40.8	8 04.0	12.1	153 27.5	34.6	296 54.6	28.6	118 29.4	36.9
16	340 43.3	23 03.4	11.2	168 29.4	34.4	311 57.0	28.7	133 31.7	36.9
17	355 45.8	38 02.7	10.3	183 31.3	34.3	326 59.4	28.7	148 34.0	36.9
18	10 48.2	53 02.1	S18 09.4	198 33.2	N 6 34.1	342 01.8	N10 28.7	163 36.3	S 8 37.0
19	25 50.7	68 01.5	08.5	213 35.1	33.9	357 04.2	28.8	178 38.6	37.0
20	40 53.2	83 00.9	07.5	228 37.0	33.7	12 06.6	28.8	193 41.0	37.1
21	55 55.6	98 00.3	06.6	243 38.9	33.6	27 09.1	28.8	208 43.3	37.1
22	70 58.1	112 59.7	05.7	258 40.8	33.4	42 11.5	28.9	223 45.6	37.2
23	86 00.5	127 59.1	04.8	273 42.7	33.2	57 13.9	28.9	238 47.9	37.2
	h m								
Mer. Pass.	17 20.8	*v* −0.6	*d* 0.9	*v* 1.9	*d* 0.2	*v* 2.4	*d* 0.0	*v* 2.3	*d* 0.0

STARS		
Name	SHA	Dec
	° ′	° ′
Acamar	315 18.8	S40 15.6
Achernar	335 27.3	S57 10.8
Acrux	173 10.4	S63 09.7
Adhara	255 12.9	S28 59.4
Aldebaran	290 50.2	N16 32.0
Alioth	166 21.6	N55 53.3
Alkaid	152 59.8	N49 14.9
Al Na'ir	27 45.3	S46 54.2
Alnilam	275 47.1	S 1 11.8
Alphard	217 56.8	S 8 42.8
Alphecca	126 12.1	N26 40.3
Alpheratz	357 44.6	N29 09.7
Altair	62 09.6	N 8 54.1
Ankaa	353 16.7	S42 14.6
Antares	112 27.8	S26 27.4
Arcturus	145 56.8	N19 07.0
Atria	107 31.1	S69 02.7
Avior	234 17.8	S59 32.9
Bellatrix	278 32.8	N 6 21.5
Betelgeuse	271 02.1	N 7 24.4
Canopus	263 56.0	S52 42.2
Capella	280 35.5	N46 00.6
Deneb	49 32.6	N45 19.6
Denebola	182 34.6	N14 30.1
Diphda	348 56.9	S17 55.3
Dubhe	193 52.6	N61 40.8
Elnath	278 13.5	N28 37.0
Eltanin	90 47.2	N51 29.3
Enif	33 48.4	N 9 56.0
Fomalhaut	15 25.2	S29 33.6
Gacrux	172 02.1	S57 10.6
Gienah	175 53.3	S17 36.5
Hadar	148 49.6	S60 25.6
Hamal	328 01.8	N23 31.3
Kaus Aust.	83 45.6	S34 22.6
Kochab	137 20.6	N74 06.1
Markab	13 39.5	N15 16.4
Menkar	314 15.9	N 4 08.2
Menkent	148 08.9	S36 25.6
Miaplacidus	221 39.2	S69 45.9
Mirfak	308 41.5	N49 54.4
Nunki	75 59.9	S26 16.8
Peacock	53 21.4	S56 41.8
Pollux	243 28.6	N27 59.6
Procyon	245 00.5	N 5 11.5
Rasalhague	96 07.7	N12 33.1
Regulus	207 44.4	N11 54.3
Rigel	281 12.7	S 8 11.4
Rigil Kent.	139 53.5	S60 52.8
Sabik	102 14.0	S15 44.3
Schedar	349 41.7	N56 36.6
Shaula	96 23.7	S37 06.6
Sirius	258 34.3	S16 44.1
Spica	158 32.4	S11 13.5
Suhail	222 52.8	S43 28.9
Vega	80 40.1	N38 47.8
Zuben'ubi	137 06.7	S16 05.5

	SHA	Mer. Pass.
	° ′	h m
Venus	44 23.7	14 27
Mars	188 09.6	4 50
Jupiter	331 15.5	19 16
Saturn	152 54.5	7 11

UT	SUN				MOON						
	GHA		Dec		GHA	v		Dec		d	HP
d h	°	′	°	′	°	′	′	°	′	′	′
30 00	179	28.1	S23	12.0	116	00.5	14.8	S 1	55.7	11.8	55.5
01	194	27.8		11.8	130	34.3	14.9	1	43.9	11.8	55.4
02	209	27.5		11.7	145	08.2	14.9	1	32.1	11.8	55.4
03	224	27.2	. .	11.5	159	42.1	14.9	1	20.3	11.9	55.4
04	239	26.9		11.4	174	16.0	15.0	1	08.4	11.8	55.4
05	254	26.6		11.2	188	50.0	15.0	0	56.6	11.8	55.3
06	269	26.3	S23	11.1	203	24.0	15.0	S 0	44.8	11.8	55.3
07	284	26.0		10.9	217	58.0	15.0	0	33.0	11.7	55.3
08	299	25.7		10.8	232	32.0	15.1	0	21.3	11.8	55.3
F 09	314	25.4	. .	10.6	247	06.1	15.1	S 0	09.5	11.8	55.2
R 10	329	25.1		10.4	261	40.2	15.1	N 0	02.3	11.7	55.2
I 11	344	24.8		10.3	276	14.3	15.2	0	14.0	11.8	55.2
D 12	359	24.5	S23	10.1	290	48.5	15.2	N 0	25.8	11.7	55.2
A 13	14	24.2		10.0	305	22.7	15.2	0	37.5	11.7	55.1
Y 14	29	23.9		09.8	319	56.9	15.2	0	49.2	11.7	55.1
15	44	23.6	. .	09.6	334	31.1	15.3	1	00.9	11.7	55.1
16	59	23.3		09.5	349	05.4	15.2	1	12.6	11.7	55.1
17	74	23.0		09.3	3	39.6	15.3	1	24.3	11.6	55.1
18	89	22.7	S23	09.1	18	13.9	15.3	N 1	35.9	11.7	55.0
19	104	22.4		09.0	32	48.2	15.4	1	47.6	11.6	55.0
20	119	22.1		08.8	47	22.6	15.3	1	59.2	11.6	55.0
21	134	21.8	. .	08.6	61	56.9	15.4	2	10.8	11.6	55.0
22	149	21.5		08.5	76	31.3	15.4	2	22.4	11.5	54.9
23	164	21.2		08.3	91	05.7	15.3	2	33.9	11.6	54.9
31 00	179	20.9	S23	08.1	105	40.0	15.4	N 2	45.5	11.5	54.9
01	194	20.6		07.9	120	14.4	15.5	2	57.0	11.5	54.9
02	209	20.3		07.8	134	48.9	15.4	3	08.5	11.5	54.9
03	224	20.0	. .	07.6	149	23.3	15.4	3	20.0	11.5	54.8
04	239	19.7		07.4	163	57.7	15.5	3	31.5	11.4	54.8
05	254	19.4		07.2	178	32.2	15.4	3	42.9	11.4	54.8
06	269	19.1	S23	07.1	193	06.6	15.5	N 3	54.3	11.4	54.8
07	284	18.8		06.9	207	41.1	15.4	4	05.7	11.4	54.8
S 08	299	18.5		06.7	222	15.5	15.5	4	17.1	11.3	54.7
A 09	314	18.2	. .	06.5	236	50.0	15.5	4	28.4	11.4	54.7
T 10	329	17.9		06.4	251	24.5	15.5	4	39.8	11.3	54.7
U 11	344	17.6		06.2	265	59.0	15.5	4	51.1	11.2	54.7
R 12	359	17.3	S23	06.0	280	33.5	15.4	N 5	02.3	11.3	54.7
D 13	14	17.0		05.8	295	07.9	15.5	5	13.6	11.2	54.7
A 14	29	16.7		05.6	309	42.4	15.5	5	24.8	11.2	54.6
Y 15	44	16.4	. .	05.5	324	16.9	15.5	5	36.0	11.1	54.6
16	59	16.1		05.3	338	51.4	15.5	5	47.1	11.1	54.6
17	74	15.8		05.1	353	25.9	15.5	5	58.2	11.1	54.6
18	89	15.5	S23	04.9	8	00.4	15.4	N 6	09.3	11.1	54.6
19	104	15.2		04.7	22	34.8	15.5	6	20.4	11.0	54.6
20	119	14.9		04.5	37	09.3	15.5	6	31.4	11.0	54.6
21	134	14.6	. .	04.3	51	43.8	15.5	6	42.4	11.0	54.5
22	149	14.3		04.2	66	18.3	15.4	6	53.4	10.9	54.5
23	164	14.0		04.0	80	52.7	15.5	7	04.3	10.9	54.5
1 00	179	13.7	S23	03.8	95	27.2	15.4	N 7	15.2	10.9	54.5
01	194	13.4		03.6	110	01.6	15.4	7	26.1	10.8	54.5
02	209	13.1		03.4	124	36.0	15.5	7	36.9	10.8	54.5
03	224	12.8	. .	03.2	139	10.5	15.4	7	47.7	10.8	54.5
04	239	12.5		03.0	153	44.9	15.4	7	58.5	10.7	54.4
05	254	12.2		02.8	168	19.3	15.4	8	09.2	10.7	54.4
06	269	11.9	S23	02.6	182	53.7	15.3	N 8	19.9	10.7	54.4
07	284	11.6		02.4	197	28.0	15.4	8	30.6	10.6	54.4
08	299	11.3		02.2	212	02.4	15.3	8	41.2	10.5	54.4
S 09	314	11.0	. .	02.0	226	36.7	15.4	8	51.7	10.6	54.4
U 10	329	10.8		01.8	241	11.1	15.3	9	02.3	10.5	54.4
N 11	344	10.5		01.6	255	45.4	15.3	9	12.8	10.4	54.4
D 12	359	10.2	S23	01.4	270	19.7	15.2	N 9	23.2	10.4	54.4
A 13	14	09.9		01.2	284	53.9	15.3	9	33.6	10.4	54.3
Y 14	29	09.6		01.0	299	28.2	15.2	9	44.0	10.3	54.3
15	44	09.3	. .	00.8	314	02.4	15.2	9	54.3	10.3	54.3
16	59	09.0		00.6	328	36.6	15.2	10	04.6	10.3	54.3
17	74	08.7		00.4	343	10.8	15.2	10	14.9	10.2	54.3
18	89	08.4	S23	00.2	357	45.0	15.1	N10	25.1	10.1	54.3
19	104	08.1	23	00.0	12	19.1	15.2	10	35.2	10.1	54.3
20	119	07.8	22	59.8	26	53.3	15.1	10	45.3	10.1	54.3
21	134	07.5	. .	59.6	41	27.4	15.0	10	55.4	10.0	54.3
22	149	07.2		59.4	56	01.4	15.1	11	05.4	10.0	54.3
23	164	06.9		59.2	70	35.5	15.0	N11	15.4	9.9	54.3
	SD	16.3	d	0.2	SD		15.0		14.9		14.8

Lat.	Twilight Naut.	Twilight Civil	Sunrise	Moonrise 30	Moonrise 31	Moonrise 1	Moonrise 2
°	h m	h m	h m	h m	h m	h m	h m
N 72	08 25	10 47	▬	10 34	10 17	09 59	09 37
N 70	08 06	09 51	▬	10 34	10 24	10 13	10 00
68	07 50	09 18	▬	10 34	10 29	10 24	10 18
66	07 38	08 54	10 30	10 34	10 33	10 33	10 33
64	07 27	08 35	09 51	10 34	10 37	10 40	10 45
62	07 18	08 19	09 24	10 34	10 40	10 47	10 55
60	07 09	08 06	09 03	10 34	10 43	10 52	11 04
N 58	07 02	07 55	08 46	10 34	10 45	10 58	11 11
56	06 56	07 44	08 32	10 34	10 48	11 02	11 18
54	06 50	07 36	08 19	10 34	10 50	11 06	11 24
52	06 44	07 28	08 08	10 34	10 52	11 10	11 30
50	06 39	07 20	07 59	10 34	10 53	11 13	11 35
45	06 27	07 04	07 38	10 34	10 57	11 21	11 46
N 40	06 17	06 51	07 22	10 34	11 00	11 27	11 55
35	06 08	06 40	07 08	10 34	11 03	11 32	12 03
30	05 59	06 29	06 55	10 34	11 05	11 37	12 09
20	05 43	06 11	06 35	10 35	11 10	11 45	12 21
N 10	05 27	05 54	06 16	10 35	11 13	11 52	12 32
0	05 10	05 37	05 59	10 35	11 17	11 59	12 42
S 10	04 52	05 19	05 42	10 35	11 21	12 06	12 52
20	04 29	04 59	05 23	10 35	11 24	12 13	13 03
30	04 01	04 34	05 01	10 35	11 29	12 22	13 15
35	03 42	04 19	04 48	10 35	11 31	12 27	13 22
40	03 19	04 01	04 34	10 35	11 34	12 32	13 30
45	02 49	03 39	04 16	10 36	11 38	12 39	13 40
S 50	02 05	03 09	03 54	10 36	11 42	12 47	13 51
52	01 38	02 55	03 43	10 36	11 44	12 50	13 57
54	00 56	02 37	03 31	10 36	11 46	12 54	14 03
56	////	02 16	03 17	10 36	11 48	12 59	14 09
58	////	01 47	03 01	10 36	11 50	13 04	14 17
S 60	////	01 01	02 41	10 36	11 53	13 10	14 25

Lat.	Sunset	Twilight Civil	Twilight Naut.	Moonset 30	Moonset 31	Moonset 1	Moonset 2
°	h m	h m	h m	h m	h m	h m	h m
N 72	▬	13 19	15 41	23 28	25 14	01 14	03 05
N 70	▬	14 15	16 00	23 24	25 03	01 03	02 44
68	▬	14 48	16 16	23 21	24 54	00 54	02 27
66	13 36	15 12	16 28	23 19	24 46	00 46	02 14
64	14 15	15 31	16 39	23 17	24 40	00 40	02 03
62	14 42	15 47	16 48	23 15	24 35	00 35	01 54
60	15 03	16 00	16 56	23 13	24 30	00 30	01 46
N 58	15 20	16 11	17 04	23 12	24 26	00 26	01 39
56	15 34	16 21	17 10	23 11	24 22	00 22	01 33
54	15 47	16 30	17 16	23 10	24 19	00 19	01 27
52	15 58	16 38	17 22	23 09	24 16	00 16	01 22
50	16 07	16 46	17 27	23 08	24 13	00 13	01 18
45	16 28	17 01	17 38	23 06	24 07	00 07	01 08
N 40	16 44	17 15	17 49	23 04	24 02	00 02	01 00
35	16 58	17 26	17 58	23 02	23 58	24 53	00 53
30	17 10	17 37	18 06	23 01	23 54	24 47	00 47
20	17 31	17 55	18 23	22 59	23 48	24 37	00 37
N 10	17 49	18 12	18 38	22 57	23 42	24 28	00 28
0	18 07	18 29	18 55	22 55	23 37	24 20	00 20
S 10	18 24	18 47	19 14	22 53	23 32	24 11	00 11
20	18 43	19 07	19 36	22 51	23 26	24 02	00 02
30	19 04	19 32	20 05	22 49	23 20	23 52	24 26
35	19 17	19 47	20 23	22 48	23 16	23 46	24 18
40	19 32	20 05	20 46	22 46	23 12	23 39	24 09
45	19 50	20 27	21 16	22 45	23 08	23 32	23 58
S 50	20 12	20 56	22 00	22 43	23 02	23 22	23 46
52	20 22	21 10	22 26	22 42	22 59	23 18	23 40
54	20 34	21 28	23 07	22 41	22 56	23 14	23 33
56	20 48	21 49	////	22 39	22 53	23 08	23 26
58	21 04	22 18	////	22 38	22 50	23 03	23 18
S 60	21 24	23 02	////	22 37	22 46	22 56	23 09

Day	SUN Eqn. of Time 00h	SUN Eqn. of Time 12h	SUN Mer. Pass.	MOON Mer. Pass. Upper	MOON Mer. Pass. Lower	MOON Age	MOON Phase
d	m s	m s	h m	h m	h m	d	%
30	02 07	02 21	12 02	16 45	04 24	06	33
31	02 36	02 50	12 03	17 27	05 06	07	43
1	03 05	03 19	12 03	18 09	05 48	08	52

EXPLANATION

PRINCIPLE AND ARRANGEMENT

1. *Object.* The object of this Almanac is to provide, in a convenient form, the data required for the practice of astronomical navigation at sea.

2. *Principle.* The main contents of the Almanac consist of data from which the *Greenwich Hour Angle* (GHA) and the *Declination* (Dec) of all the bodies used for navigation can be obtained for any instant of *Universal Time* (UT), or *Greenwich Mean Time* (GMT). The *Local Hour Angle* (LHA) can then be obtained by means of the formula:

$$\text{LHA} = \text{GHA} \begin{matrix} - \text{ west} \\ + \text{ east} \end{matrix} \text{ longitude}$$

The remaining data consist of: times of rising and setting of the Sun and Moon, and times of twilight; miscellaneous calendarial and planning data and auxiliary tables, including a list of Standard Times; corrections to be applied to observed altitude.

For the Sun, Moon, and planets the GHA and Dec are tabulated directly for each hour of UT throughout the year. For the stars the *Sidereal Hour Angle* (SHA) is given, and the GHA is obtained from:

$$\text{GHA Star} = \text{GHA Aries} + \text{SHA Star}$$

The SHA and Dec of the stars change slowly and may be regarded as constant over periods of several days. GHA Aries, or the Greenwich Hour Angle of the first point of Aries (the Vernal Equinox), is tabulated for each hour. Permanent tables give the appropriate increments and corrections to the tabulated hourly values of GHA and Dec for the minutes and seconds of UT.

The six-volume series of *Sight Reduction Tables for Marine Navigation* (published in U.S.A. as Pub. No. 229 and in U.K. as N.P. 401) has been designed for the solution of the navigational triangle and is intended for use with *The Nautical Almanac*.

Two alternative procedures for sight reduction are described on pages 277–318. The first requires the use of programmable calculators or computers, while the second uses a set of concise tables that is given on pages 286–317.

The tabular accuracy is 0′.1 throughout. The time argument on the daily pages of this Almanac is $12^h +$ the Greenwich Hour Angle of the mean sun and is here denoted by UT, although it is also known as GMT. This scale may differ from the broadcast time signals (UTC) by an amount which, if ignored, will introduce an error of up to 0′.2 in longitude determined from astronomical observations. (The difference arises because the time argument depends on the variable rate of rotation of the Earth while the broadcast time signals are now based on an atomic time-scale.) Step adjustments of exactly one second are made to the time signals as required (normally at 24^h on December 31 and June 30) so that the difference between the time signals and UT, as used in this Almanac, may not exceed $0^s.9$. Those who require to reduce observations to a precision of better than 1^s must therefore obtain the correction (DUT1) to the time signals from coding in the signal, or from other sources; the required time is given by UT1=UTC+DUT1 to a precision of $0^s.1$. Alternatively, the longitude, when determined from astronomical observations, may be corrected by the corresponding amount shown in the following table:

Correction to time signals	Correction to longitude
$-0^s.9$ to $-0^s.7$	0′.2 to east
$-0^s.6$ to $-0^s.3$	0′.1 to east
$-0^s.2$ to $+0^s.2$	no correction
$+0^s.3$ to $+0^s.6$	0′.1 to west
$+0^s.7$ to $+0^s.9$	0′.2 to west

3. *Lay-out.* The ephemeral data for three days are presented on an opening of two pages: the left-hand page contains the data for the planets and stars; the right-hand page contains the data for the Sun and Moon, together with times of twilight, sunrise, sunset, moonrise and moonset.

The remaining contents are arranged as follows: for ease of reference the altitude-correction tables are given on pages A2, A3, A4, xxxiv and xxxv; calendar, Moon's phases, eclipses, and planet notes (i.e. data of general interest) precede the main tabulations. The Explanation is followed by information on standard times, star charts and list of star positions, sight reduction procedures and concise sight reduction tables, tables of increments and corrections and other auxiliary tables that are frequently used.

MAIN DATA

4. *Daily pages.* The daily pages give the GHA of Aries, the GHA and Dec of the Sun, Moon, and the four navigational planets, for each hour of UT. For the Moon, values of v and d are also tabulated for each hour to facilitate the correction of GHA and Dec to intermediate times; v and d for the Sun and planets change so slowly that they are given, at the foot of the appropriate columns, once only on the page; v is zero for Aries and negligible for the Sun, and is omitted. The SHA and Dec of the 57 selected stars, arranged in alphabetical order of proper name, are also given.

5. *Stars.* The SHA and Dec of 173 stars, including the 57 selected stars, are tabulated for each month on pages 268–273; no interpolation is required and the data can be used in precisely the same way as those for the selected stars on the daily pages. The stars are arranged in order of SHA.

The list of 173 includes all stars down to magnitude 3·0, together with a few fainter ones to fill the larger gaps. The 57 selected stars have been chosen from amongst these on account of brightness and distribution in the sky; they will suffice for the majority of observations.

The 57 selected stars are known by their proper names, but they are also numbered in descending order of SHA. In the list of 173 stars, the constellation names are always given on the left-hand page; on the facing page proper names are given where well-known names exist. Numbers for the selected stars are given in both columns.

An index to the selected stars, containing lists in both alphabetical and numerical order, is given on page xxxiii and is also reprinted on the bookmark.

6. *Increments and corrections.* The tables printed on tinted paper (pages ii xxxi) at the back of the Almanac provide the increments and corrections for minutes and seconds to be applied to the hourly values of GHA and Dec. They consist of sixty tables, one for each minute, separated into two parts: increments to GHA for Sun and planets, Aries, and Moon for every minute and second; and, for each minute, corrections to be applied to GHA and Dec corresponding to the values of v and d given on the daily pages.

The increments are based on the following adopted hourly rates of increase of the GHA: Sun and planets, 15° precisely; Aries, 15° 02′46; Moon, 14° 19′0. The values of v on the daily pages are the excesses of the actual hourly motions over the adopted values; they are generally positive, except for Venus. The tabulated hourly values of the Sun's GHA have been adjusted to reduce to a minimum the error caused by treating v as negligible. The values of d on the daily pages are the hourly differences of the Dec. For the Moon, the true values of v and d are given for each hour; otherwise mean values are given for the three days on the page.

7. *Method of entry.* The UT of an observation is expressed as a day and hour, followed by a number of minutes and seconds. The tabular values of GHA and Dec, and, where necessary, the corresponding values of v and d, are taken directly from the daily pages for the day and hour of UT; this hour is always *before* the time of observation. SHA and Dec of the selected stars are also taken from the daily pages.

The table of Increments and Corrections for the minute of UT is then selected. For the GHA, the increment for minutes and seconds is taken from the appropriate column opposite the seconds of UT; the v-correction is taken from the second part of the same table opposite the value of v as given on the daily pages. Both increment and v-correction are to be added to the GHA, except for Venus when v is prefixed by a minus sign and the v-correction is to be subtracted. For the Dec there is no increment, but a d-correction is applied in the same way as the v-correction; d is given without sign on the daily pages and the sign of the correction is to be supplied by inspection of the Dec column. In many cases the correction may be applied mentally.

8. *Examples.* (a) Sun and Moon. Required the GHA and Dec of the Sun and Moon on 2011 February 10 at $15^h\ 47^m\ 13^s$ UT.

		SUN			MOON			
		GHA	Dec	d	GHA	v	Dec	d
		° ′	° ′	′	° ′	′	° ′	′
Daily page, February 10^d 15^h		41 26·8	S 14 19·7	0·8	325 07·0	12·1	N 19 36·8	7·4
Increments for	$47^m\ 13^s$	11 48·3			11 16·0			
v or d corrections for	47^m		−0·6		+9·6		+5·9	
Sum for	February 10^d 15^h 47^m 13^s	53 15·1	S 14 19·1		336 32·6		N 19 42·7	

(b) Planets. Required the LHA and Dec of (i) Venus on 2011 February 10 at $12^h\ 25^m\ 25^s$ UT in longitude W 103° 57′; (ii) Jupiter on 2011 February 10 at $13^h\ 37^m\ 25^s$ UT in longitude E 80° 20′.

		VENUS				JUPITER			
		GHA	v	Dec	d	GHA	v	Dec	d
		° ′	′	° ′	′	° ′	′	° ′	′
Daily page, Feb. 10^d	(12^h)	42 34·5	−0·6	S 21 08·3	0·0	(13^h) 331 25·1	2·0	N 0 25·1	0·2
Increments (planets)	($25^m\ 25^s$)	6 21·3				($37^m\ 25^s$) 9 21·3			
v or d corrections	(25^m)	−0·3		+0·0		(37^m) +1·3		+0·1	
Sum = GHA and Dec.		48 55·5		S 21 08·3		340 47·7		N 0 25·2	
Longitude	(west)	−103 57·0				(east) + 80 20·0			
Multiples of 360°		+360				−360			
LHA planet		304 58·5				61 07·7			

(c) Stars. Required the GHA and Dec of (i) *Vega* on 2011 February 10 at $7^h\ 03^m\ 27^s$ UT; (ii) *Alpheratz* on 2011 February 10 at $19^h\ 23^m\ 27^s$ UT.

		Vega			*Alpheratz*		
		GHA	Dec		GHA	Dec	
		° ′	° ′		° ′	° ′	
Daily page (SHA and Dec)		80 40·4	N 38 47.5		357 45·5	N 29 09.2	
Daily page (GHA Aries)	(7^h)	245 01·0		(19^h)	65 30·6		
Increments (Aries)	($03^m\ 27^s$)	0 51·9		($23^m\ 27^s$)	5 52·7		
Sum = GHA star		326 33·3			429 08·8		
Multiples of 360°					−360		
GHA star		326 33·3			69 08·8		

9. *Polaris (Pole Star) tables.* The tables on pages 274–276 provide means by which the latitude can be deduced from an observed altitude of *Polaris*, and they also give its azimuth; their use is explained and illustrated on those pages. They are based on the following formula:

$$\text{Latitude} - H_O = -p\cos h + \tfrac{1}{2}p\ \sin\ p\ \sin^2 h\ \tan(\text{latitude})$$

where

H_O = Apparent altitude (corrected for refraction)

p = polar distance of *Polaris* = 90° − Dec

h = local hour angle of *Polaris* = LHA Aries + SHA

a_0, which is a function of LHA Aries only, is the value of both terms of the above formula calculated for mean values of the SHA (318° 26′) and Dec (N 89° 18′·9) of *Polaris*, for a mean latitude of 50°, and adjusted by the addition of a constant (58′·8).

a_1, which is a function of LHA Aries and latitude, is the excess of the value of the second term over its mean value for latitude 50°, increased by a constant (0′.6) to make it always positive. a_2, which is a function of LHA Aries and date, is the correction to the first term for the variation of *Polaris* from its adopted mean position; it is increased by a constant (0′.6) to make it positive. The sum of the added constants is 1°, so that:

$$\text{Latitude} = \text{Apparent altitude (corrected for refraction)} - 1^\circ + a_0 + a_1 + a_2$$

RISING AND SETTING PHENOMENA

10. *General.* On the right-hand daily pages are given the times of sunrise and sunset, of the beginning and end of civil and nautical twilights, and of moonrise and moonset for a range of latitudes from N 72° to S 60°. These times, which are given to the nearest minute, are strictly the UT of the phenomena on the Greenwich meridian; they are given for every day for moonrise and moonset, but only for the middle day of the three on each page for the solar phenomena.

They are approximately the Local Mean Times (LMT) of the corresponding phenomena on other meridians; they can be formally interpolated if desired. The UT of a phenomenon is obtained from the LMT by:

$$\text{UT} = \text{LMT} \begin{matrix} + \text{ west} \\ - \text{ east} \end{matrix} \text{ longitude}$$

in which the longitude must first be converted to time by the table on page i or otherwise.

Interpolation for latitude can be done mentally or with the aid of Table I on page xxxii.

The following symbols are used to indicate the conditions under which, in high latitudes, some of the phenomena do not occur:

▭ Sun or Moon remains continuously above the horizon;

▬ Sun or Moon remains continuously below the horizon;

//// twilight lasts all night.

Basis of the tabulations. At sunrise and sunset 16′ is allowed for semi-diameter and 34′ for horizontal refraction, so that at the times given the Sun's upper limb is on the visible horizon; all times refer to phenomena as seen from sea level with a clear horizon.

At the times given for the beginning and end of twilight, the Sun's zenith distance is 96° for civil, and 102° for nautical twilight. The degree of illumination at the times given for civil twilight (in good conditions and in the absence of other illumination) is such that the brightest stars are visible and the horizon is clearly defined. At the times given for nautical twilight the horizon is in general not visible, and it is too dark for observation with a marine sextant.

Times corresponding to other depressions of the Sun may be obtained by interpolation or, for depressions of more than 12°, less reliably, by extrapolation; times so obtained will be subject to considerable uncertainty near extreme conditions.

At moonrise and moonset allowance is made for semi-diameter, parallax, and refraction (34′), so that at the times given the Moon's upper limb is on the visible horizon as seen from sea level.

11. *Sunrise, sunset, twilight.* The tabulated times may be regarded, without serious error, as the LMT of the phenomena on any of the three days on the page and in any longitude. Precise times may normally be obtained by interpolating the tabular values for latitude and to the correct day and longitude, the latter being expressed as a fraction of a day by dividing it by 360°, positive for west and negative for east longitudes. In the extreme conditions near ▭, ▬ or //// interpolation may not be possible in one direction, but accurate times are of little value in these circumstances.

Examples. Required the UT of (a) the beginning of morning twilights and sunrise on 2011 January 10 for latitude S 48° 55′, longitude E 75° 18′; (b) sunset and the end of evening twilights on 2011 January 12 for latitude N 67° 10′, longitude W 168° 05′.

	(a)	Twilight Nautical	Twilight Civil	Sunrise	(b)	Sunset	Twilight Civil	Twilight Nautical
		d h m	d h m	d h m		d h m	d h m	d h m
From p. 17								
LMT for Lat	S 45°	10 03 04	10 03 51	10 04 27	N 66°	12 14 11	12 15 34	12 16 47
Corr. to	S 48° 55′	−30	−20	−16	N 67° 10′	−26	−12	−6
(p. xxxii, Table I)								
Long (p. i)	E 75° 18′	−5 01	−5 01	−5 01	W 168° 05′	+11 12	+11 12	+11 12
UT		9 21 33	9 22 30	9 23 10		13 00 57	13 02 34	13 03 53

The LMT are strictly for January 11 (middle date on page) and 0° longitude; for more precise times it is necessary to interpolate, but rounding errors may accumulate to about 2^m.

(a) to January $10^d - 75°/360° = \text{Jan. } 9^d8$, i.e. $\frac{1}{3}(1{\cdot}2) = 0{\cdot}4$ backwards towards the data for the same latitude interpolated similarly from page 15; the corrections are -2^m to nautical twilight, -2^m to civil twilight and -1^m to sunrise.

(b) to January $12^d + 168°/360° = \text{Jan. } 12^d5$, i.e. $\frac{1}{3}(1{\cdot}5) = 0{\cdot}5$ forwards towards the data for the same latitude interpolated similarly from page 19; the corrections are $+7^m$ to sunset, $+4^m$ to civil twilight, and $+3^m$ to nautical twilight.

12. *Moonrise, moonset.* Precise times of moonrise and moonset are rarely needed; a glance at the tables will generally give sufficient indication of whether the Moon is available for observation and of the hours of rising and setting. If needed, precise times may be obtained as follows. Interpolate for latitude, using Table I on page xxxii, on the day wanted and also on the preceding day in east longitudes or the following day in west longitudes; take the difference between these times and interpolate for longitude by applying to the time for the day wanted the correction from Table II on page xxxii, so that the resulting time is between the two times used. In extreme conditions near □ or ■ interpolation for latitude or longitude may be possible only in one direction; accurate times are of little value in these circumstances.

To facilitate this interpolation the times of moonrise and moonset are given for four days on each page; where no phenomenon occurs during a particular day (as happens once a month) the time of the phenomenon on the following day, increased by 24^h, is given; extra care must be taken when interpolating between two values, when one of those values exceeds 24^h. In practice it suffices to use the daily difference between the times for the nearest tabular latitude, and generally, to enter Table II with the nearest tabular arguments as in the examples below.

Examples. Required the UT of moonrise and moonset in latitude S 47° 10′, longitudes E 124° 00′ and W 78° 31′ on 2011 January 12.

	Longitude E 124° 00′ Moonrise	Longitude E 124° 00′ Moonset	Longitude W 78° 31′ Moonrise	Longitude W 78° 31′ Moonset
	d h m	d h m	d h m	d h m
LMT for Lat. S 45°	12 12 45	12 23 04	12 12 45	12 23 04
Lat correction (p. xxxii, Table I)	+04	−04	+04	−04
Long correction (p. xxxii, Table II)	−23	−07	+16	+07
Correct LMT	12 12 26	12 22 53	12 13 05	12 23 07
Longitude (p. i)	−8 16	−8 16	+5 14	+5 14
UT	12 04 10	12 14 37	12 18 19	13 04 21

ALTITUDE CORRECTION TABLES

13. *General.* In general two corrections are given for application to altitudes observed with a marine sextant; additional corrections are required for Venus and Mars and also for very low altitudes.

Tables of the correction for dip of the horizon, due to height of eye above sea level, are given on pages A2 and xxxiv. Strictly this correction should be applied first and subtracted from the sextant altitude to give apparent altitude, which is the correct argument for the other tables.

Separate tables are given of the second correction for the Sun, for stars and planets (on pages A2 and A3), and for the Moon (on pages xxxiv and xxxv). For the Sun, values are given for both lower and upper limbs, for two periods of the year. The star tables are used for the planets, but additional corrections for parallax (page A2) are required for Venus and Mars. The Moon tables are in two parts: the main correction is a function of apparent altitude only and is tabulated for the lower limb (30′ must be subtracted to obtain the correction for the upper limb); the other, which is given for both lower and upper limbs, depends also on the horizontal parallax, which has to be taken from the daily pages.

An additional correction, given on page A4, is required for the change in the refraction, due to variations of pressure and temperature from the adopted standard conditions; it may generally be ignored for altitudes greater than 10°, except possibly in extreme conditions. The correction tables for the Sun, stars, and planets are in two parts; only those for altitudes greater than 10° are reprinted on the bookmark.

14. *Critical tables.* Some of the altitude correction tables are arranged as critical tables. In these an interval of apparent altitude (or height of eye) corresponds to a single value of the correction; no interpolation is required. At a "critical" entry the upper of the two possible values of the correction is to be taken. For example, in the table of dip, a correction of −4′.1 corresponds to all values of the height of eye from 5·3 to 5·5 metres (17·5 to 18·3 feet) inclusive.

15. *Examples.* The following examples illustrate the use of the altitude correction tables; the sextant altitudes given are assumed to be taken on 2011 June 28 1 with a marine sextant at height 5·4 metres (18 feet), temperature −3°C and pressure 982 mb, the Moon sights being taken at about 10^h UT.

	SUN lower limb	SUN upper limb	MOON lower limb	MOON upper limb	VENUS	*Polaris*
	° ′	° ′	° ′	° ′	° ′	° ′
Sextant altitude	21 19·7	3 20·2	33 27·6	26 06·7	4 32·6	49 36·5
Dip, height 5·4 metres (18 feet)	−4·1	−4·1	−4·1	−4·1	−4·1	−4·1
Main correction	+13·6	−29·3	+57·4	+60·5	−10·8	−0·8
−30′ for upper limb (Moon)	—	—	—	−30·0	—	—
L, U correction for Moon	—	—	+2·6	+2·3	—	—
Additional correction for Venus	—	—	—	—	+0·1	—
Additional refraction correction	−0·1	−0·6	−0·1	−0·1	−0·5	0·0
Corrected sextant altitude	21 29·1	2 46·2	34 23·4	26 35·3	4 17·3	49 31·6

The main corrections have been taken out with apparent altitude (sextant altitude corrected for index error and dip) as argument, interpolating where possible. These refinements are rarely necessary.

16. *Composition of the Corrections.* The table for the dip of the sea horizon is based on the formula:

$$\text{Correction for dip} = -1'.76\sqrt{(\text{height of eye in metres})} = -0'.97\sqrt{(\text{height of eye in feet})}$$

The correction table for the Sun includes the effects of semi-diameter, parallax and mean refraction.

The correction tables for the stars and planets allow for the effect of mean refraction.

The phase correction for Venus has been incorporated in the tabulations for GHA and Dec, and no correction for phase is required. The additional corrections for Venus and Mars allow for parallax. Alternatively, the correction for parallax may be calculated from $p \cos H$, where p is the parallax and H is the altitude. In 2011 the values for p are:

	Jan. 1	Feb. 18	Dec. 31
Venus	0′.2	0′.1	
	Jan. 1	Dec. 31	
Mars	0′.1		

The correction table for the Moon includes the effect of semi-diameter, parallax, augmentation and mean refraction.

Mean refraction is calculated for a temperature of 10°C (50°F), a pressure of 1010 mb (29·83 inches), humidity of 80% and wavelength 0·50169 μm.

17. *Bubble sextant observations.* When observing with a bubble sextant no correction is necessary for dip, semi-diameter, or augmentation. The altitude corrections for the stars and planets on page A2 and on the bookmark should be used for the Sun as well as for the stars and planets; for the Moon it is easiest to take the mean of the corrections for lower and upper limbs and subtract 15′ from the altitude; the correction for dip must not be applied.

AUXILIARY AND PLANNING DATA

18. *Sun and Moon.* On the daily pages are given: hourly values of the horizontal parallax of the Moon; the semi-diameters and the times of meridian passage of both Sun and Moon over the Greenwich meridian; the equation of time; the age of the Moon, the percent (%) illuminated and a symbol indicating the phase. The times of the phases of the Moon are given in UT on page 4. For the Moon, the semi-diameters for each of the three days are given at the foot of the column; for the Sun a single value is sufficient. Table II on page xxxii may be used for interpolating the time of the Moon's meridian passage for longitude. The equation of time is given daily at 00^h and 12^h UT. The sign is *positive* for unshaded values and *negative* for shaded values. To obtain apparent time add the equation of time to mean time when the sign is *positive*. Subtract the equation of time from mean time when the sign is *negative*. At 12^h UT, when the sign is *positive*, meridian passage of the Sun occurs *before* 12^h UT, otherwise it occurs *after* 12^h UT.

19. *Planets.* The magnitudes of the planets are given immediately following their names in the headings on the daily pages; also given, for the middle day of the three on the page, are their SHA at 00^h UT and their times of meridian passage.

The planet notes and diagram on pages 8 and 9 provide descriptive information as to the suitability of the planets for observation during the year, and of their positions and movements.

20. *Stars.* The time of meridian passage of the first point of Aries over the Greenwich meridian is given on the daily pages, for the middle day of the three on the page, to $0^m.1$. The interval between successive meridian passages is $23^h\ 56^m.1$ (24^h less $3^m.9$) so that times for intermediate days and other meridians can readily be derived. If a precise time is required it may be obtained by finding the UT at which LHA Aries is zero.

The meridian passage of a star occurs when its LHA is zero, that is when LHA Aries + SHA = 360°. An approximate time can be obtained from the planet diagram on page 9.

The star charts on pages 266 and 267 are intended to assist identification. They show the relative positions of the stars in the sky as seen from the Earth and include all 173 stars used in the Almanac, together with a few others to complete the main constellation configurations. The local meridian at any time may be located on the chart by means of its SHA which is 360° − LHA Aries, or west longitude − GHA Aries.

21. *Star globe.* To set a star globe on which is printed a scale of LHA Aries, first set the globe for latitude and then rotate about the polar axis until the scale under the edge of the meridian circle reads LHA Aries.

To mark the positions of the Sun, Moon, and planets on the star globe, take the difference GHA Aries − GHA body and use this along the LHA Aries scale, in conjunction with the declination, to plot the position. GHA Aries − GHA body is most conveniently found by taking the difference when the GHA of the body is small (less than 15°), which happens once a day.

22. *Calendar.* On page 4 are given lists of ecclesiastical festivals, and of the principal anniversaries and holidays in the United Kingdom and the United States of America. The calendar on page 5 includes the day of the year as well as the day of the week.

Brief particulars are given, at the foot of page 5, of the solar and lunar eclipses occurring during the year; the times given are in UT. The principal features of the more important solar eclipses are shown on the maps on pages 6 and 7.

23. *Standard times.* The lists on pages 262–265 give the standard times used in most countries. In general no attempt is made to give details of the beginning and end of summer time, since they are liable to frequent changes at short notice. For the latest information consult Admiralty List of Radio Signals Volume 2 (NP 282) corrected by Section VI of the weekly edition of Admiralty Notices to Mariners.

The Date or Calendar Line is an arbitrary line, on either side of which the date differs by one day; when crossing this line on a westerly course, the date must be advanced one day; when crossing it on an easterly course, the date must be put back one day. The line is a modification of the line of the 180th meridian, and is drawn so as to include, as far as possible, islands of any one group, etc., on the same side of the line. It may be traced by starting at the South Pole and joining up to the following positions:

Lat	S	51·0	S	45·0	S	15·0	S	5·0	N	48·0	N	53·0	N	65·5
Long		180·0	W	172·5	W	172·5		180·0		180·0	E	170·0	W	169·0

thence through the middle of the Diomede Islands to Lat N 68°·0, Long W 169°·0, passing east of Ostrov Vrangelya (Wrangel Island) to Lat N 75°·0, Long 180°·0, and thence to the North Pole.

ACCURACY

24. *Main data.* The quantities tabulated in this Almanac are generally correct to the nearest 0′·1; the exception is the Sun's GHA which is deliberately adjusted by up to 0′·15 to reduce the error due to ignoring the v-correction. The GHA and Dec at intermediate times cannot be obtained to this precision, since at least two quantities must be added; moreover, the v- and d-corrections are based on mean values of v and d and are taken from tables for the whole minute only. The largest error that can occur in the GHA or Dec of any body other than the Sun or Moon is less than 0′·2; it may reach 0′·25 for the GHA of the Sun and 0′·3 for that of the Moon.

In practice it may be expected that only one third of the values of GHA and Dec taken out will have errors larger than 0′·05 and less than one tenth will have errors larger than 0′·1.

25. *Altitude corrections.* The errors in the altitude corrections are nominally of the same order as those in GHA and Dec, as they result from the addition of several quantities each correctly rounded off to 0′·1. But the actual values of the dip and of the refraction at low altitudes may, in extreme atmospheric conditions, differ considerably from the mean values used in the tables.

USE OF THIS ALMANAC IN 2012

This Almanac may be used for the Sun and stars in 2012 in the following manner.

For the Sun, take out the GHA and Dec for the same date but, for January and February (for February 29 use March 1), for a time $5^h\ 48^m\ 00^s$ *earlier* and, for March to December, for a time $18^h\ 12^m\ 00^s$ *later* than the UT of observation; in both cases *add* 87° 00′ to the GHA so obtained. The error, mainly due to planetary perturbations of the Earth, is unlikely to exceed 0′·4.

For the stars, calculate the GHA and Dec for the same date and the same time, but for January and February (for February 29 use March 1) *subtract* 15′·1 and for March to December *add* 44′·0 to the GHA so found. The error, due to incomplete correction for precession and nutation, is unlikely to exceed 0′·4. If preferred, the same result can be obtained by using a time $5^h\ 48^m\ 00^s$ earlier for January and February (for February 29 use March 1) and $18^h\ 12^m\ 00^s$ later for March to December, than the UT of observation (as for the Sun) and adding 86° 59′·2 to the GHA (or adding 87° as for the Sun and subtracting 0′·8, for precession, from the SHA of the star).

The Almanac cannot be so used for the Moon or planets.

LIST I — PLACES FAST ON UTC (mainly those EAST OF GREENWICH)

The times given below should be } *added* to UTC to give Standard Time
} *subtracted* from Standard Time to give UTC.

	h	m
Admiralty Islands	10	
Afghanistan	04	30
Albania*	01	
Algeria	01	
Amirante Islands	04	
Andaman Islands	05	30
Angola	01	
Armenia*	04	
Australia		
Australian Capital Territory*	10	
New South Wales*[1]	10	
Northern Territory	09	30
Queensland	10	
South Australia*	09	30
Tasmania*	10	
Victoria*	10	
Western Australia	08	
Whitsunday Islands	10	
Austria*†	01	
Azerbaijan*	04	
Bahrain	03	
Balearic Islands*†	01	
Bangladesh	07	
Belarus*	02	
Belgium*†	01	
Benin	01	
Bosnia and Herzegovina*	01	
Botswana, Republic of	02	
Brunei	08	
Bulgaria*†	02	
Burma (Myanmar)	06	30
Burundi	02	
Cambodia	07	
Cameroon Republic	01	
Caroline Islands[2]	10	
Central African Republic	01	
Chad	01	
Chagos Archipelago & Diego Garcia	06	
Chatham Islands*	12	45
China, People's Republic of	08	
Christmas Island, Indian Ocean	07	
Cocos (Keeling) Islands	06	30
Comoro Islands (Comoros)	03	
Congo, Democratic Republic		
West: Kinshasa, Equateur	01	
East: Orientale, Kasai, Kivu, Shaba	02	
Congo Republic	01	
Corsica*†	01	
Crete*†	02	
Croatia*	01	
Cyprus†: Ercan*, Larnaca*	02	
Czech Republic*†	01	

	h	m
Denmark*†	01	
Djibouti	03	
Egypt, Arab Republic of*	02	
Equatorial Guinea, Republic of	01	
Eritrea	03	
Estonia*†	02	
Ethiopia	03	
Fiji*	12	
Finland*†	02	
France*†	01	
Gabon	01	
Georgia	04	
Germany*†	01	
Gibraltar*	01	
Greece*†	02	
Guam	10	
Hong Kong	08	
Hungary*†	01	
India	05	30
Indonesia, Republic of		
Bangka, Billiton, Java, West and Central Kalimantan, Madura, Sumatra	07	
Bali, Flores, South and East Kalimantan, Lombok, Sulawesi, Sumba, Sumbawa, West Timor	08	
Aru, Irian Jaya, Kai, Moluccas, Tanimbar	09	
Iran*	03	30
Iraq	03	
Israel*	02	
Italy*†	01	
Jan Mayen Island*	01	
Japan	09	
Jordan*	02	
Kazakhstan		
Western: Aktau, Uralsk, Atyrau	05	
Eastern & Central: Kzyl-Orda, Astana	06	
Kenya	03	
Kerguelen Islands	05	
Kiribati Republic		
Gilbert Islands	12	
Phoenix Islands[3]	13	
Line Islands[3]	14	
Korea, North	09	
Korea, South	09	
Kuril Islands	11	
Kuwait	03	
Kyrgyzstan	06	
Laccadive Islands	05	30
Laos	07	
Latvia*†	02	

* Daylight-saving time may be kept in these places. † For Summer time dates see List II footnotes.

1 Except Broken Hill Area* which keeps $09^h\ 30^m$.

2 Except Pohnpei, Pingelap and Kosrae which keep 11^h and Palau which keeps 09^h.

3 The Line and Phoenix Is. not part of the Kiribati Republic keep 10^h and 11^h, respectively, slow on UTC.

LIST I — (*continued*)

	h	m
Lebanon*	02	
Lesotho	02	
Libya	02	
Liechtenstein*	01	
Lithuania*†	02	
Lord Howe Island*	10	30
Luxembourg*†	01	
Macau	08	
Macedonia*, former Yugoslav Republic	01	
Macias Nguema (Fernando Póo)	01	
Madagascar, Democratic Republic of	03	
Malawi	02	
Malaysia, Malaya, Sabah, Sarawak	08	
Maldives, Republic of The	05	
Malta*†	01	
Mariana Islands	10	
Marshall Islands	12	
Mauritius	04	
Moldova*	02	
Monaco*	01	
Mongolia	08	
Montenegro*	01	
Mozambique	02	
Namibia*	01	
Nauru	12	
Nepal	05	45
Netherlands, The*†	01	
New Caledonia	11	
New Zealand*	12	
Nicobar Islands	05	30
Niger	01	
Nigeria, Republic of	01	
Norfolk Island	11	30
Norway*	01	
Novaya Zemlya	03	
Okinawa	09	
Oman	04	
Pagalu (Annobon Islands)	01	
Pakistan*	05	
Palau Islands	09	
Papua New Guinea	10	
Pescadores Islands	08	
Philippine Republic	08	
Poland*†	01	
Qatar	03	
Reunion	04	
Romania*†	02	
Russia[1]*		
Zone 1 Kaliningrad	02	
Zone 2 Moscow, St Petersburg, Arkhangelsk, Astrakhan	03	
Zone 3 Samara, Izhevsk	04	
Zone 4 Perm, Amderna, Novyy Port	05	
Zone 5 Omsk, Novosibirsk	06	
Russia (*continued*)		
Zone 6 Norilsk, Kyzyl, Dikson	07	
Zone 7 Bratsk, Irkutsk, Ulan-Ude	08	
Zone 8 Yakutsk, Chita, Tiksi	09	
Zone 9 Vladivostok, Khabarovsk, Okhotsk	10	
Zone 10 Magadan	11	
Zone 11 Petropavlovsk, Pevek	12	
Rwanda	02	
Ryukyu Islands	09	
Sakhalin Island*	10	
Santa Cruz Islands	11	
Sardinia*†	01	
Saudi Arabia	03	
Schouten Islands	09	
Serbia*	01	
Seychelles	04	
Sicily*†	01	
Singapore	08	
Slovakia*†	01	
Slovenia*†	01	
Socotra	03	
Solomon Islands	11	
Somalia Republic	03	
South Africa, Republic of	02	
Spain*†	01	
Spanish Possessions in North Africa*	01	
Spitsbergen (Svalbard)*	01	
Sri Lanka	05	30
Sudan, Republic of	03	
Swaziland	02	
Sweden*†	01	
Switzerland*	01	
Syria (Syrian Arab Republic)*	02	
Taiwan	08	
Tajikistan	05	
Tanzania	03	
Thailand	07	
Timor-Leste	09	
Tonga	13	
Tunisia*	01	
Turkey*	02	
Turkmenistan	05	
Tuvalu	12	
Uganda	03	
Ukraine*	02	
United Arab Emirates	04	
Uzbekistan	05	
Vanuatu, Republic of	11	
Vietnam, Socialist Republic of	07	
Yemen	03	
Zambia, Republic of	02	
Zimbabwe	02	

* Daylight-saving time may be kept in these places. † For Summer time dates see List II footnotes.

[1] The boundaries between the zones are irregular; listed are chief towns in each zone.

LIST II — PLACES NORMALLY KEEPING UTC

Ascension Island	Ghana	Irish Republic*†	Morocco*	Sierra Leone
Burkina-Faso	Great Britain†	Ivory Coast	Portugal*†	Togo Republic
Canary Islands*†	Guinea-Bissau	Liberia	Principe	Tristan da Cunha
Channel Islands†	Guinea Republic	Madeira*†	St. Helena	
Faeroes*, The	Iceland	Mali	São Tomé	
Gambia, The	Ireland, Northern†	Mauritania	Senegal	

* Daylight-saving time may be kept in these places.

† Summer time (daylight-saving time), one hour in advance of UTC, will be kept from 2011 March 27^{d} 01^{h} to October 30^{d} 01^{h} UTC (Ninth Summer Time Directive of the European Union). Ratification by member countries has not been verified.

LIST III — PLACES SLOW ON UTC (WEST OF GREENWICH)

The times given ⎫ *subtracted* from UTC to give Standard Time
below should be ⎭ *added* to Standard Time to give UTC.

	h	m
Argentina[1]	03	
Austral (Tubuai) Islands[2]	10	
Azores*†	01	
Bahamas*	05	
Barbados	04	
Belize	06	
Bermuda*	04	
Bolivia	04	
Brazil		
Fernando de Noronha I., Trindade I., Oceanic Is.	02	
N and NE coastal states, Bahia, Tocantins, Goiás*, Brasilia*, Minas Gerais*, Espirito Santo*, S and E coastal states*	03	
Mato Grosso do Sul*, Mato Grosso*, Rondônia, Amazonas, Roraima, Acre	04	
British Antarctic Territory[3,4]	03	
Canada[4]‡		
Alberta*	07	
British Columbia*	08	
Labrador*	04	
Manitoba*	06	
New Brunswick*	04	
Newfoundland*	03	30
Nunavut*		
east of long. W. 85°	05	
long. W. 85° to W. 102°	06	
west of long. W. 102°	07	
Northwest Territories*	07	
Nova Scotia*	04	
Ontario, east of long. W. 90°*	05	
Ontario, west of long. W. 90°*	06	
Canada (*continued*)		
Prince Edward Island*	04	
Quebec, east of long. W. 63°	04	
west of long. W. 63°*	05	
Saskatchewan	06	
Yukon*	08	
Cape Verde Islands	01	
Cayman Islands	05	
Chile*	04	
Colombia	05	
Cook Islands	10	
Costa Rica	06	
Cuba*	05	
Curaçao Island	04	
Dominican Republic	04	
Easter Island (I. de Pascua)*	06	
Ecuador	05	
El Salvador	06	
Falkland Islands*	04	
Fernando de Noronha Island	02	
French Guiana	03	
Galápagos Islands	06	
Greenland		
Danmarkshavn, Mesters Vig	00	
General*	03	
Scoresby Sound*	01	
Thule*, Pituffik*	04	
Grenada	04	
Guadeloupe	04	
Guatemala	06	
Guyana, Republic of	04	

* Daylight-saving time may be kept in these places. ‡ Dates for DST are given at the end of List III.

[1] The province of San Luis* keeps 04^{h}.

[2] This is the legal standard time, but local mean time is generally used.

[3] Stations may use UTC.

[4] Some areas may keep another time zone.

LIST III — (*continued*)

	h	m
Haiti	05	
Honduras	06	
Jamaica	05	
Johnston Island	10	
Juan Fernandez Islands*	04	
Leeward Islands	04	
Marquesas Islands	09	30
Martinique	04	
Mexico		
General*	06	
Sonora, Sinaloa*, Nayarit*, Chihuahua*, Southern District of Lower California*	07	
Northern District of Lower California*	08	
Midway Islands	11	
Nicaragua	06	
Niue	11	
Panama, Republic of	05	
Paraguay*	04	
Peru	05	
Pitcairn Island	08	
Puerto Rico	04	
St. Pierre and Miquelon*	03	
Samoa	11	
Samoa, American*	11	
Society Islands	10	
South Georgia	02	
Suriname	03	
Trindade Island, South Atlantic	02	
Trinidad and Tobago	04	
Tuamotu Archipelago	10	
Tubuai (Austral) Islands	10	
Turks and Caicos Islands*	05	
United States of America‡		
Alabama	06	
Alaska	09	
Aleutian Islands, east of W. 169° 30′	09	
Aleutian Islands, west of W. 169° 30′	10	
Arizona[1,2]	07	
Arkansas	06	
California	08	
Colorado	07	
Connecticut	05	
Delaware	05	
District of Columbia	05	
Florida[2]	05	
Georgia	05	
Hawaii[1]	10	

	h	m
United States of America‡(*continued*)		
Idaho, southern part	07	
northern part	08	
Illinois	06	
Indiana[2]	05	
Iowa	06	
Kansas[2]	06	
Kentucky, eastern part	05	
western part	06	
Louisiana	06	
Maine	05	
Maryland	05	
Massachusetts	05	
Michigan[2]	05	
Minnesota	06	
Mississippi	06	
Missouri	06	
Montana	07	
Nebraska, eastern part	06	
western part	07	
Nevada	08	
New Hampshire	05	
New Jersey	05	
New Mexico	07	
New York	05	
North Carolina	05	
North Dakota, eastern part	06	
western part	07	
Ohio	05	
Oklahoma	06	
Oregon[2]	08	
Pennsylvania	05	
Rhode Island	05	
South Carolina	05	
South Dakota, eastern part	06	
western part	07	
Tennessee, eastern part	05	
western part	06	
Texas[2]	06	
Utah	07	
Vermont	05	
Virginia	05	
Washington D.C.	05	
Washington	08	
West Virginia	05	
Wisconsin	06	
Wyoming	07	
Uruguay*	03	
Venezuela	04	30
Virgin Islands	04	
Windward Islands	04	

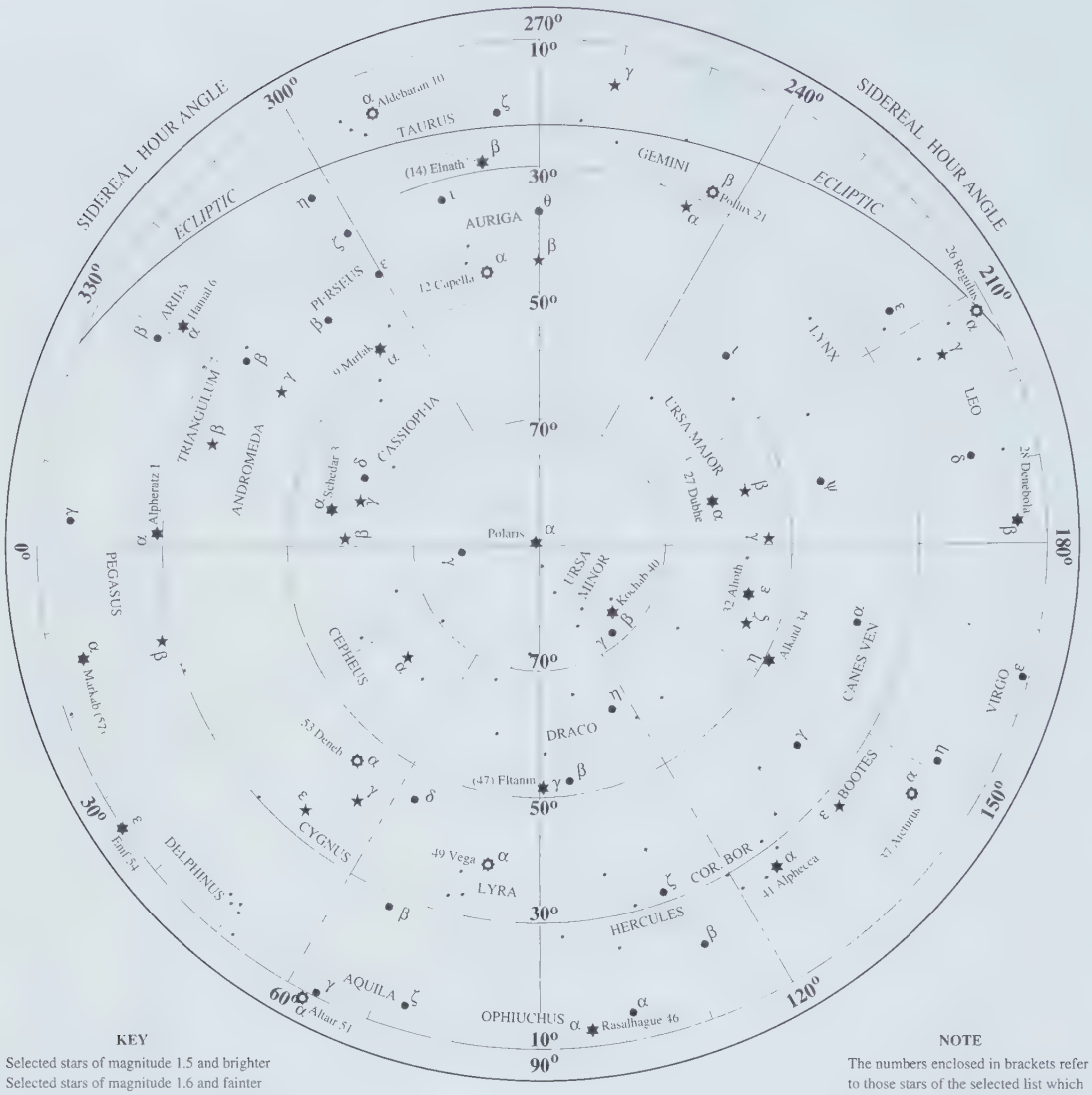
* Daylight-saving time may be kept in these places.

‡ Daylight-saving (Summer) time, one hour fast on the time given, is kept during 2011 from the March 13 (second Sunday) to November 6 (first Sunday), changing at $02^h\ 00^m$ local clock time.

1 Exempt from keeping daylight-saving time.

2 A small portion of the state is in another time zone.

NORTHERN STARS



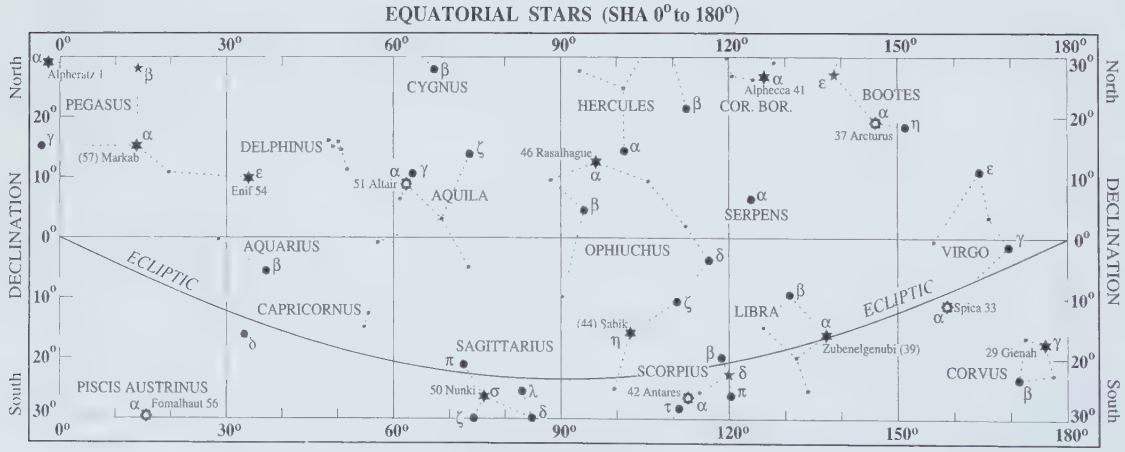
KEY

- Selected stars of magnitude 1.5 and brighter
- Selected stars of magnitude 1.6 and fainter
- ★ Other tabulated stars of magnitude 2.5 and brighter
- ● Other tabulated stars of magnitude 2.6 and fainter
- • Untabulated stars

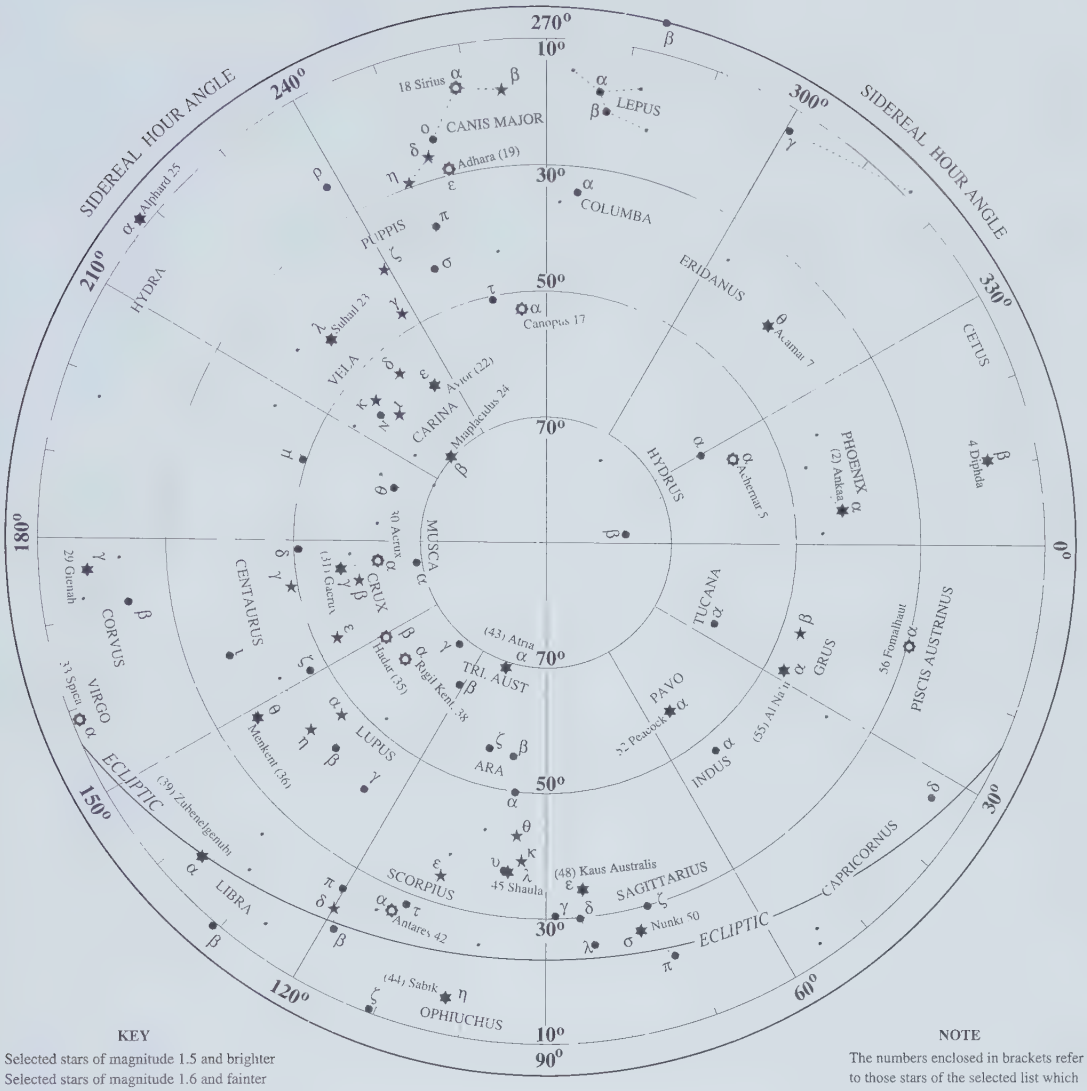
NOTE

The numbers enclosed in brackets refer to those stars of the selected list which are not used in Sight Reduction Tables H.O. 249, A.P. 3270, N.P. 303.

EQUATORIAL STARS (SHA 0° to 180°)



SOUTHERN STARS



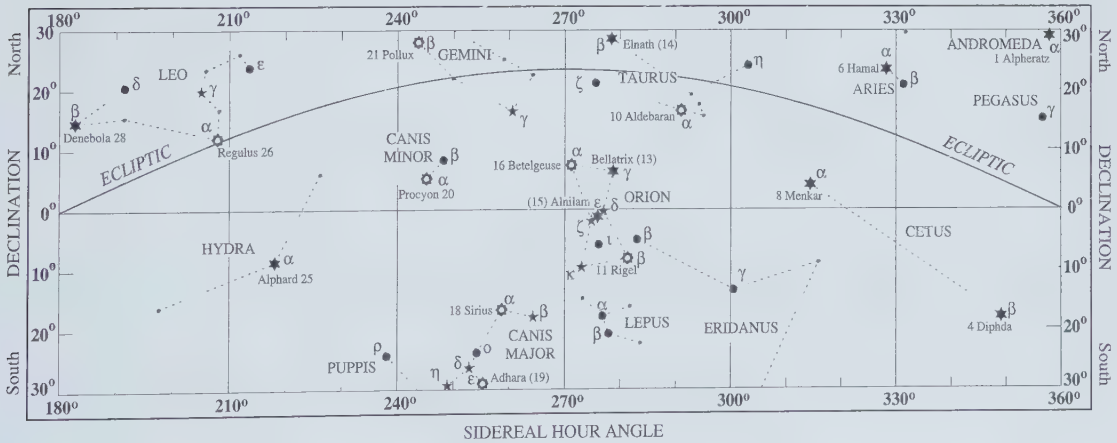
KEY

- Selected stars of magnitude 1.5 and brighter
- Selected stars of magnitude 1.6 and fainter
- Other tabulated stars of magnitude 2.5 and brighter
- Other tabulated stars of magnitude 2.6 and fainter
- Untabulated stars

NOTE

The numbers enclosed in brackets refer to those stars of the selected list which are not used in Sight Reduction Tables H.O. 249, A.P. 3270, N.P. 303.

EQUATORIAL STARS (SHA 180° to 360°)



Mag.	Name and Number		SHA							Declination							
				JAN.	FEB.	MAR.	APR.	MAY	JUNE		JAN.	FEB.	MAR.	APR.	MAY	JUNE
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
3·2	γ Cephei		5	03·4	03·9	04·0	03·8	03·1	02·3	N 77	42·0	41·9	41·8	41·6	41·6	41·6
2·5	α Pegasi	57	13	40·3	40·3	40·3	40·2	40·0	39·7	N 15	16·0	16·0	15·9	15·9	15·9	16·0
2·4	β Pegasi		13	55·3	55·4	55·3	55·2	55·0	54·7	N 28	08·8	08·7	08·6	08·6	08·6	08·6
1·2	α Piscis Aust.	56	15	26·1	26·1	26·1	25·9	25·7	25·5	S 29	33·9	33·8	33·7	33·6	33·5	33·4
2·1	β Gruis		19	10·2	10·2	10·2	10·0	09·7	09·4	S 46	49·7	49·6	49·5	49·3	49·2	49·1
2·9	α Tucanæ		25	11·4	11·4	11·3	11·1	10·7	10·3	S 60	12·4	12·2	12·1	11·9	11·8	11·7
1·7	α Gruis	55	27	46·2	46·2	46·1	45·9	45·6	45·3	S 46	54·5	54·4	54·3	54·2	54·0	54·0
2·9	δ Capricorni		33	05·3	05·2	05·1	05·0	04·8	04·5	S 16	04·6	04·6	04·6	04·5	04·4	04·3
2·4	ε Pegasi	54	33	49·1	49·1	49·0	48·8	48·6	48·4	N 9	55·6	55·6	55·5	55·6	55·6	55·7
2·9	β Aquarii		36	57·9	57·9	57·8	57·6	57·4	57·2	S 5	31·3	31·3	31·3	31·3	31·2	31·1
2·4	α Cephei		40	17·9	17·9	17·8	17·4	17·0	16·6	N 62	38·2	38·0	37·9	37·8	37·8	37·9
2·5	ε Cygni		48	20·3	20·2	20·1	19·9	19·6	19·4	N 34	00·8	00·7	00·6	00·6	00·6	00·8
1·3	α Cygni	53	49	33·2	33·1	32·9	32·7	32·4	32·1	N 45	19·3	19·2	19·1	19·0	19·1	19·2
3·1	α Indi		50	25·0	24·9	24·7	24·4	24·1	23·8	S 47	15·2	15·1	15·0	14·9	14·8	14·8
1·9	α Pavonis	52	53	22·5	22·3	22·1	21·7	21·3	21·0	S 56	42·0	41·8	41·7	41·6	41·6	41·6
2·2	γ Cygni		54	20·9	20·8	20·6	20·4	20·1	19·9	N 40	17·6	17·5	17·4	17·4	17·4	17·6
0·8	α Aquilæ	51	62	10·3	10·2	10·0	09·8	09·5	09·3	N 8	53·9	53·8	53·8	53·8	53·9	54·0
2·7	γ Aquilæ		63	18·3	18·2	18·0	17·8	17·6	17·4	N 10	38·5	38·4	38·3	38·4	38·4	38·5
2·9	δ Cygni		63	40·5	40·4	40·2	39·9	39·7	39·4	N 45	09·5	09·4	09·3	09·3	09·3	09·5
3·1	β Cygni		67	12·7	12·6	12·4	12·1	11·9	11·7	N 27	59·0	58·9	58·8	58·8	58·9	59·0
2·9	π Sagittarii		72	23·8	23·6	23·4	23·1	22·9	22·7	S 21	00·3	00·3	00·3	00·3	00·2	00·2
3·0	ζ Aquilæ		73	31·3	31·2	31·0	30·8	30·6	30·4	N 13	52·8	52·7	52·7	52·7	52·8	52·9
2·6	ζ Sagittarii		74	10·4	10·2	10·0	09·7	09·4	09·2	S 29	51·8	51·8	51·7	51·7	51·7	51·7
2·0	σ Sagittarii	50	75	60·8	60·6	60·4	60·2	59·9	59·7	S 26	16·9	16·9	16·9	16·9	16·8	16·8
0·0	α Lyræ	49	80	40·6	40·4	40·2	39·9	39·7	39·5	N 38	47·6	47·5	47·4	47·4	47·5	47·7
2·8	λ Sagittarii		82	50·3	50·1	49·8	49·6	49·4	49·2	S 25	24·9	24·9	24·9	24·8	24·8	24·8
1·9	ε Sagittarii	48	83	46·5	46·3	46·0	45·7	45·5	45·3	S 34	22·7	22·7	22·6	22·6	22·6	22·6
2·7	δ Sagittarii		84	34·5	34·3	34·1	33·8	33·6	33·4	S 29	49·3	49·3	49·3	49·3	49·3	49·3
3·0	γ Sagittarii		88	22·3	22·0	21·8	21·5	21·3	21·1	S 30	25·4	25·3	25·3	25·3	25·3	25·3
2·2	γ Draconis	47	90	47·4	47·2	46·9	46·6	46·4	46·3	N 51	29·1	29·0	28·9	29·0	29·1	29·3
2·8	β Ophiuchi		93	59·8	59·6	59·4	59·1	59·0	58·8	N 4	33·7	33·7	33·6	33·6	33·7	33·8
2·4	κ Scorpii		94	11·2	11·0	10·7	10·4	10·2	10·0	S 39	02·0	02·0	02·0	02·0	02·0	02·1
1·9	θ Scorpii		95	28·3	28·1	27·8	27·5	27·2	27·0	S 43	00·2	00·1	00·1	00·2	00·2	00·2
2·1	α Ophiuchi	46	96	08·4	08·2	07·9	07·7	07·5	07·4	N 12	33·1	33·0	32·9	33·0	33·0	33·1
1·6	λ Scorpii	45	96	24·6	24·4	24·1	23·8	23·6	23·4	S 37	06·6	06·6	06·6	06·6	06·6	06·7
3·0	α Aræ		96	49·6	49·3	49·0	48·6	48·4	48·2	S 49	52·9	52·9	52·9	52·9	53·0	53·0
2·7	υ Scorpii		97	07·3	07·0	06·7	06·5	06·2	06·1	S 37	18·2	18·2	18·2	18·2	18·2	18·2
2·8	β Draconis		97	20·1	19·9	19·6	19·3	19·1	19·0	N 52	17·4	17·3	17·3	17·3	17·4	17·6
2·8	β Aræ		98	26·8	26·4	26·1	25·7	25·4	25·2	S 55	32·2	32·2	32·2	32·2	32·3	32·4
Var.‡	α Herculis		101	12·8	12·6	12·4	12·1	12·0	11·9	N 14	22·6	22·5	22·5	22·5	22·6	22·7
2·4	η Ophiuchi	44	102	14·8	14·6	14·3	14·1	13·9	13·8	S 15	44·3	44·3	44·4	44·4	44·3	44·3
3·1	ζ Aræ		105	07·0	06·6	06·2	05·9	05·6	05·4	S 56	00·3	00·2	00·3	00·3	00·4	00·5
2·3	ε Scorpii		107	16·8	16·5	16·2	16·0	15·8	15·7	S 34	18·7	18·7	18·7	18·8	18·8	18·8
1·9	α Triang. Aust.	43	107	32·5	32·0	31·4	30·8	30·4	30·2	S 69	02·6	02·6	02·6	02·7	02·8	02·9
2·8	ζ Herculis		109	34·6	34·3	34·1	33·9	33·7	33·7	N 31	34·8	34·7	34·6	34·7	34·8	35·0
2·6	ζ Ophiuchi		110	33·4	33·2	33·0	32·8	32·6	32·5	S 10	35·4	35·4	35·5	35·5	35·4	35·4
2·8	τ Scorpii		110	51·4	51·1	50·9	50·6	50·5	50·4	S 28	14·3	14·3	14·3	14·4	14·4	14·4
2·8	β Herculis		112	19·6	19·4	19·2	19·0	18·8	18·7	N 21	27·8	27·7	27·7	27·7	27·8	27·9
1·0	α Scorpii	42	112	28·6	28·4	28·1	27·9	27·8	27·7	S 26	27·3	27·4	27·4	27·4	27·5	27·5
2·7	η Draconis		113	58·3	57·9	57·6	57·2	57·1	57·0	N 61	29·1	29·0	29·0	29·0	29·2	29·4
2·7	δ Ophiuchi		116	16·1	15·8	15·6	15·4	15·3	15·2	S 3	43·4	43·5	43·5	43·5	43·5	43·4
2·6	β Scorpii		118	28·7	28·5	28·2	28·0	27·9	27·8	S 19	50·1	50·2	50·2	50·2	50·2	50·2
2·3	δ Scorpii		119	45·1	44·8	44·6	44·4	44·3	44·2	S 22	39·2	39·2	39·2	39·3	39·3	39·3
2·9	π Scorpii		120	07·1	06·8	06·6	06·4	06·2	06·1	S 26	08·7	08·7	08·8	08·8	08·9	08·9
2·8	β Trianguli Aust.		120	58·1	57·6	57·2	56·8	56·5	56·4	S 63	27·7	27·7	27·7	27·8	27·9	28·1
2·6	α Serpentis		123	47·7	47·5	47·3	47·1	47·0	47·0	N 6	23·3	23·3	23·2	23·2	23·3	23·4
2·8	γ Lupi		126	01·7	01·4	01·1	00·9	00·7	00·7	S 41	12·1	12·1	12·2	12·3	12·4	12·4
2·2	α Coronæ Bor.	41	126	12·6	12·4	12·2	12·0	11·9	11·9	N 26	40·4	40·3	40·3	40·4	40·5	40·6

‡ 2·9 — 3·6

Mag.	Name and Number		SHA							Declination						
				JULY	AUG.	SEPT.	OCT.	NOV.	DEC.		JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
3·2	γ Cephei		5	01·5	00·9	00·7	00·8	01·2	01·8	N 77	41·6	41·8	42·0	42·2	42·3	42·4
2·5	*Markab*	57	13	39·5	39·3	39·3	39·3	39·3	39·4	N 15	16·2	16·3	16·4	16·4	16·4	16·4
2·4	*Scheat*		13	54·5	54·3	54·2	54·3	54·4	54·5	N 28	08·8	08·9	09·0	09·1	09·2	09·2
1·2	*Fomalhaut*	56	15	25·2	25·0	25·0	25·0	25·1	25·2	S 29	33·4	33·3	33·4	33·5	33·5	33·6
2·1	β Gruis		19	09·1	08·9	08·8	08·9	09·1	09·2	S 46	49·1	49·1	49·2	49·3	49·4	49·4
2·9	α Tucanæ		25	10·0	09·7	09·7	09·8	10·1	10·3	S 60	11·8	11·8	12·0	12·1	12·1	12·1
1·7	*Al Na'ir*	55	27	45·0	44·8	44·8	44·9	45·1	45·2	S 46	54·0	54·0	54·1	54·2	54·3	54·3
2·9	δ Capricorni		33	04·3	04·2	04·2	04·2	04·3	04·4	S 16	04·2	04·2	04·2	04·3	04·3	04·3
2·4	*Enif*	54	33	48·2	48·1	48·1	48·1	48·2	48·3	N 9	55·8	55·9	56·0	56·0	56·0	56·0
2·9	β Aquarii		36	57·0	56·8	56·8	56·9	57·0	57·1	S 5	31·0	31·0	30·9	30·9	31·0	31·0
2·4	*Alderamin*		40	16·4	16·3	16·4	16·7	17·0	17·3	N 62	38·1	38·3	38·4	38·6	38·6	38·6
2·5	ε Cygni		48	19·2	19·2	19·2	19·4	19·5	19·6	N 34	00·9	01·1	01·2	01·3	01·3	01·2
1·3	*Deneb*	53	49	32·0	31·9	32·0	32·2	32·4	32·5	N 45	19·4	19·5	19·7	19·8	19·8	19·7
3·1	α Indi		50	23·6	23·5	23·5	23·7	23·9	24·0	S 47	14·8	14·9	15·0	15·0	15·0	15·0
1·9	*Peacock*	52	53	20·7	20·6	20·7	20·9	21·2	21·3	S 56	41·6	41·7	41·8	41·9	41·9	41·8
2·2	γ Cygni		54	19·7	19·7	19·8	20·0	20·1	20·3	N 40	17·7	17·9	18·0	18·1	18·1	18·0
0·8	*Altair*	51	62	09·2	09·2	09·3	09·4	09·5	09·6	N 8	54·1	54·2	54·2	54·3	54·2	54·2
2·7	γ Aquilæ		63	17·3	17·3	17·3	17·5	17·6	17·6	N 10	38·6	38·7	38·8	38·8	38·8	38·7
2·9	δ Cygni		63	39·3	39·3	39·5	39·7	39·9	40·0	N 45	09·7	09·8	09·9	10·0	10·0	09·9
3·1	*Albireo*		67	11·6	11·6	11·7	11·9	12·0	12·1	N 27	59·2	59·3	59·4	59·4	59·4	59·3
2·9	π Sagittarii		72	22·6	22·6	22·7	22·8	22·9	22·9	S 21	00·2	00·2	00·2	00·2	00·2	00·2
3·0	ζ Aquilæ		73	30·3	30·3	30·4	30·5	30·7	30·7	N 13	53·0	53·1	53·1	53·2	53·1	53·0
2·6	ζ Sagittarii		74	09·1	09·1	09·2	09·4	09·5	09·5	S 29	51·7	51·7	51·7	51·7	51·7	51·7
2·0	*Nunki*	50	75	59·6	59·6	59·7	59·8	60·0	60·0	S 26	16·8	16·8	16·8	16·8	16·8	16·8
0·0	*Vega*	49	80	39·5	39·5	39·7	39·9	40·0	40·1	N 38	47·8	48·0	48·0	48·0	48·0	47·9
2·8	λ Sagittarii		82	49·1	49·1	49·2	49·4	49·5	49·5	S 25	24·8	24·8	24·8	24·8	24·8	24·8
1·9	*Kaus Australis*	48	83	45·2	45·2	45·3	45·5	45·6	45·6	S 34	22·7	22·7	22·7	22·7	22·7	22·6
2·7	δ Sagittarii		84	33·3	33·3	33·4	33·6	33·7	33·7	S 29	49·3	49·3	49·3	49·3	49·3	49·3
3·0	γ Sagittarii		88	21·1	21·1	21·2	21·4	21·5	21·4	S 30	25·4	25·4	25·4	25·4	25·4	25·3
2·2	*Eltanin*	47	90	46·3	46·4	46·6	46·9	47·1	47·2	N 51	29·4	29·6	29·6	29·6	29·5	29·4
2·8	β Ophiuchi		93	58·8	58·8	59·0	59·1	59·2	59·2	N 4	33·9	33·9	34·0	34·0	33·9	33·8
2·4	κ Scorpii		94	09·9	10·0	10·1	10·3	10·4	10·4	S 39	02·1	02·2	02·2	02·2	02·1	02·1
1·9	θ Scorpii		95	27·0	27·0	27·2	27·4	27·5	27·4	S 43	00·3	00·3	00·4	00·3	00·3	00·2
2·1	*Rasalhague*	46	96	07·4	07·5	07·6	07·7	07·8	07·8	N 12	33·2	33·3	33·3	33·3	33·3	33·2
1·6	*Shaula*	45	96	23·4	23·4	23·6	23·7	23·8	23·8	S 37	06·7	06·7	06·8	06·7	06·7	06·6
3·0	α Aræ		96	48·1	48·2	48·4	48·6	48·7	48·6	S 49	53·1	53·2	53·2	53·2	53·1	53·0
2·7	υ Scorpii		97	06·0	06·1	06·2	06·4	06·5	06·4	S 37	18·3	18·3	18·3	18·3	18·3	18·2
2·8	β Draconis		97	19·0	19·2	19·4	19·7	19·9	19·9	N 52	17·8	17·9	17·9	17·9	17·8	17·6
2·8	β Aræ		98	25·1	25·2	25·5	25·7	25·8	25·8	S 55	32·5	32·5	32·6	32·5	32·4	32·3
Var.‡	α Herculis		101	11·9	11·9	12·1	12·2	12·3	12·2	N 14	22·8	22·8	22·9	22·8	22·8	22·7
2·4	*Sabik*	44	102	13·8	13·9	14·0	14·1	14·2	14·1	S 15	44·3	44·3	44·3	44·3	44·3	44·3
3·1	ζ Aræ		105	05·4	05·5	05·8	06·0	06·1	06·0	S 56	00·6	00·6	00·6	00·6	00·5	00·4
2·3	ε Scorpii		107	15·6	15·7	15·9	16·0	16·1	16·0	S 34	18·9	18·9	18·9	18·9	18·8	18·8
1·9	*Atria*	43	107	30·2	30·5	30·9	31·2	31·4	31·3	S 69	03·0	03·1	03·1	03·0	02·9	02·8
2·8	ζ Herculis		109	33·7	33·8	34·0	34·1	34·2	34·2	N 31	35·1	35·2	35·2	35·1	35·0	34·9
2·6	ζ Ophiuchi		110	32·5	32·6	32·7	32·8	32·9	32·8	S 10	35·4	35·4	35·3	35·3	35·3	35·4
2·8	τ Scorpii		110	50·3	50·4	50·6	50·7	50·7	50·6	S 28	14·4	14·4	14·4	14·4	14·3	14·3
2·8	β Herculis		112	18·8	18·9	19·0	19·1	19·2	19·1	N 21	28·0	28·1	28·1	28·1	28·0	27·8
1·0	*Antares*	42	112	27·6	27·7	27·9	28·0	28·0	27·9	S 26	27·5	27·5	27·5	27·4	27·4	27·4
2·7	η Draconis		113	57·2	57·5	57·8	58·2	58·3	58·3	N 61	29·5	29·6	29·6	29·5	29·3	29·2
2·7	δ Ophiuchi		116	15·2	15·3	15·4	15·5	15·6	15·5	S 3	43·4	43·4	43·3	43·3	43·4	43·4
2·6	β Scorpii		118	27·8	27·9	28·0	28·1	28·1	28·0	S 19	50·2	50·2	50·2	50·2	50·2	50·2
2·3	*Dschubba*		119	44·2	44·3	44·4	44·5	44·5	44·4	S 22	39·3	39·3	39·3	39·3	39·2	39·2
2·9	π Scorpii		120	06·2	06·2	06·4	06·5	06·5	06·4	S 26	08·9	08·9	08·9	08·8	08·8	08·8
2·8	β Trianguli Aust.		120	56·5	56·7	57·0	57·3	57·3	57·1	S 63	28·2	28·2	28·2	28·1	28·0	27·9
2·6	α Serpentis		123	47·0	47·1	47·2	47·3	47·3	47·2	N 6	23·4	23·5	23·5	23·5	23·4	23·3
2·8	γ Lupi		126	00·7	00·8	01·0	01·1	01·1	00·9	S 41	12·5	12·5	12·4	12·4	12·3	12·3
2·2	*Alphecca*	41	126	11·9	12·1	12·2	12·3	12·3	12·2	N 26	40·7	40·8	40·7	40·7	40·6	40·4

‡ 2·9 — 3·6

Mag.	Name and Number		SHA							Declination						
				JAN.	FEB.	MAR.	APR.	MAY	JUNE		JAN.	FEB.	MAR.	APR.	MAY	JUNE
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
3·1	γ Ursæ Minoris		129	49·7	49·2	48·7	48·3	48·2	48·4	N 71	47·3	47·2	47·3	47·4	47·6	47·7
2·9	γ Trianguli Aust.		129	60·6	60·0	59·5	59·1	58·8	58·8	S 68	43·0	43·0	43·1	43·2	43·3	43·5
2·6	β Libræ		130	35·8	35·6	35·4	35·2	35·1	35·1	S 9	25·5	25·5	25·6	25·6	25·6	25·6
2·7	β Lupi		135	10·9	10·6	10·3	10·1	10·0	10·0	S 43	10·6	10·6	10·7	10·8	10·9	11·0
2·8	α Libræ	39	137	07·5	07·2	07·0	06·8	06·8	06·7	S 16	05·3	05·4	05·4	05·5	05·5	05·5
2·1	β Ursæ Minoris	40	137	20·2	19·6	19·0	18·7	18·6	18·9	N 74	06·2	06·2	06·2	06·4	06·5	06·7
2·4	ε Bootis		138	37·9	37·6	37·4	37·3	37·2	37·2	N 27	01·4	01·4	01·4	01·4	01·5	01·7
2·3	α Lupi		139	19·8	19·4	19·1	18·9	18·8	18·8	S 47	26·0	26·1	26·1	26·3	26·4	26·4
−0·3	α Centauri	38	139	54·3	53·9	53·6	53·3	53·2	53·2	S 60	52·6	52·7	52·8	52·9	53·1	53·2
2·3	η Centauri		140	56·6	56·3	56·0	55·9	55·8	55·8	S 42	12·3	12·3	12·4	12·5	12·6	12·7
3·0	γ Bootis		141	52·1	51·8	51·6	51·4	51·4	51·4	N 38	15·3	15·2	15·2	15·3	15·5	15·6
0·0	α Bootis	37	145	57·3	57·1	56·9	56·8	56·8	56·8	N 19	07·3	07·2	07·2	07·2	07·3	07·4
2·1	θ Centauri	36	148	09·7	09·4	09·2	09·1	09·0	09·0	S 36	25·4	25·5	25·6	25·7	25·7	25·8
0·6	β Centauri	35	148	50·5	50·1	49·8	49·6	49·5	49·6	S 60	25·4	25·5	25·6	25·7	25·9	26·0
2·6	ζ Centauri		150	56·2	55·9	55·6	55·5	55·4	55·5	S 47	20·4	20·5	20·6	20·8	20·9	21·0
2·7	η Bootis		151	11·6	11·4	11·2	11·1	11·1	11·1	N 18	20·3	20·2	20·2	20·3	20·4	20·4
1·9	η Ursæ Majoris	34	152	60·2	59·9	59·7	59·6	59·6	59·7	N 49	15·1	15·1	15·1	15·2	15·4	15·5
2·3	ε Centauri		154	50·8	50·4	50·2	50·0	50·0	50·0	S 53	31·2	31·3	31·4	31·6	31·7	31·8
1·0	α Virginis	33	158	33·1	32·8	32·7	32·6	32·6	32·6	S 11	13·2	13·3	13·4	13·4	13·4	13·4
2·3	ζ Ursæ Majoris		158	54·2	53·9	53·7	53·6	53·6	53·8	N 54	51·7	51·6	51·7	51·8	52·0	52·1
2·8	ι Centauri		159	41·4	41·1	40·9	40·8	40·8	40·8	S 36	46·2	46·3	46·4	46·5	46·6	46·6
2·8	ε Virginis		164	18·8	18·6	18·4	18·4	18·4	18·4	N 10	53·8	53·7	53·7	53·7	53·8	53·8
2·9	α Canum Venat.		165	51·5	51·3	51·1	51·1	51·1	51·2	N 38	15·2	15·1	15·2	15·3	15·4	15·5
1·8	ε Ursæ Majoris	32	166	22·0	21·7	21·4	21·4	21·5	21·7	N 55	53·6	53·6	53·7	53·8	53·9	54·0
1·3	β Crucis		167	54·0	53·6	53·4	53·3	53·3	53·5	S 59	44·8	44·9	45·1	45·2	45·4	45·5
2·9	γ Virginis		169	26·4	26·1	26·0	26·0	26·0	26·0	S 1	30·8	30·9	30·9	30·9	30·9	30·9
2·2	γ Centauri		169	27·6	27·3	27·2	27·1	27·1	27·2	S 49	01·1	01·3	01·4	01·6	01·7	01·7
2·7	α Muscæ		170	31·7	31·2	30·9	30·8	30·9	31·2	S 69	11·6	11·7	11·9	12·1	12·2	12·3
2·7	β Corvi		171	15·1	14·9	14·7	14·7	14·7	14·8	S 23	27·5	27·6	27·7	27·8	27·8	27·8
1·6	γ Crucis	31	172	02·8	02·4	02·2	02·2	02·3	02·4	S 57	10·4	10·5	10·7	10·8	11·0	11·0
1·3	α Crucis	30	173	11·1	10·8	10·6	10·5	10·6	10·8	S 63	09·5	09·6	09·8	10·0	10·1	10·2
2·6	γ Corvi	29	175	54·0	53·8	53·6	53·6	53·7	53·7	S 17	36·3	36·4	36·5	36·5	36·6	36·6
2·6	δ Centauri		177	45·5	45·2	45·1	45·1	45·2	45·3	S 50	46·9	47·1	47·2	47·4	47·5	47·5
2·4	γ Ursæ Majoris		181	23·4	23·1	23·0	23·0	23·1	23·3	N 53	37·6	37·6	37·7	37·9	38·0	38·0
2·1	β Leonis	28	182	35·2	35·0	34·9	34·9	35·0	35·1	N 14	30·4	30·3	30·3	30·3	30·4	30·4
2·6	δ Leonis		191	19·1	18·9	18·8	18·9	18·9	19·0	N 20	27·5	27·5	27·5	27·5	27·6	27·6
3·0	ψ Ursæ Majoris		192	25·2	25·0	24·9	25·0	25·1	25·2	N 44	26·0	26·0	26·1	26·2	26·2	26·3
1·8	α Ursæ Majoris	27	193	53·2	52·9	52·9	53·0	53·2	53·5	N 61	41·1	41·2	41·3	41·4	41·5	41·5
2·4	β Ursæ Majoris		194	21·8	21·5	21·5	21·5	21·7	21·9	N 56	19·0	19·1	19·2	19·3	19·4	19·4
2·7	μ Velorum		198	10·7	10·5	10·5	10·6	10·7	10·9	S 49	28·7	28·9	29·0	29·2	29·2	29·2
2·8	θ Carinæ		199	09·0	08·8	08·7	08·9	09·1	09·4	S 64	27·1	27·2	27·4	27·6	27·7	27·7
2·3	γ Leonis		204	50·7	50·6	50·6	50·6	50·7	50·8	N 19	46·9	46·9	46·9	46·9	47·0	47·0
1·4	α Leonis	26	207	45·1	44·9	44·9	45·0	45·1	45·2	N 11	54·6	54·5	54·5	54·5	54·6	54·6
3·0	ε Leonis		213	22·2	22·1	22·1	22·2	22·3	22·4	N 23	43·1	43·1	43·2	43·2	43·2	43·3
3·1	N Velorum		217	05·9	05·8	05·9	06·1	06·3	06·6	S 57	05·0	05·2	05·3	05·5	05·5	05·5
2·0	α Hydræ	25	217	57·5	57·4	57·4	57·5	57·6	57·7	S 8	42·5	42·6	42·7	42·7	42·7	42·7
2·5	κ Velorum		219	22·5	22·4	22·5	22·7	22·9	23·1	S 55	03·5	03·7	03·8	03·9	04·0	03·9
2·2	ι Carinæ		220	38·5	38·4	38·5	38·7	39·0	39·3	S 59	19·3	19·5	19·7	19·8	19·8	19·8
1·7	β Carinæ	24	221	39·3	39·2	39·4	39·8	40·2	40·6	S 69	45·7	45·9	46·1	46·2	46·3	46·2
2·2	λ Velorum	23	222	53·3	53·3	53·3	53·5	53·7	53·8	S 43	28·7	28·9	29·0	29·1	29·1	29·0
3·1	ι Ursæ Majoris		224	59·8	59·7	59·7	59·9	60·1	60·2	N 47	59·6	59·7	59·8	59·9	59·9	59·9
2·0	δ Velorum		228	44·2	44·1	44·3	44·5	44·7	44·9	S 54	45·0	45·2	45·3	45·4	45·4	45·4
1·9	ε Carinæ	22	234	18·1	18·2	18·3	18·6	18·9	19·1	S 59	32·7	32·9	33·1	33·2	33·2	33·1
1·8	γ Velorum		237	31·2	31·2	31·4	31·6	31·8	31·9	S 47	22·2	22·4	22·5	22·6	22·6	22·5
2·8	ρ Puppis		237	59·2	59·2	59·2	59·4	59·5	59·6	S 24	20·3	20·4	20·5	20·5	20·5	20·5
2·3	ζ Puppis		238	59·8	59·8	59·9	60·1	60·2	60·4	S 40	02·2	02·3	02·4	02·5	02·5	02·4
1·1	β Geminorum	21	243	29·4	29·4	29·5	29·6	29·7	29·8	N 27	59·8	59·8	59·9	59·9	59·9	59·9
0·4	α Canis Minoris	20	245	01·2	01·2	01·2	01·4	01·5	01·5	N 5	11·6	11·6	11·6	11·6	11·6	11·6

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				JULY	AUG.	SEPT.	OCT.	NOV.	DEC.		JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
3·1	γ Ursæ Minoris		129	48·8	49·3	49·8	50·2	50·4	50·3	N 71	47·8	47·8	47·8	47·7	47·5	47·3
2·9	γ Trianguli Aust.		129	59·0	59·3	59·7	59·9	59·9	59·6	S 68	43·6	43·6	43·6	43·4	43·3	43·2
2·6	β Libræ		130	35·1	35·2	35·3	35·4	35·4	35·2	S 9	25·5	25·5	25·5	25·5	25·5	25·6
2·7	β Lupi		135	10·1	10·2	10·4	10·5	10·4	10·2	S 43	11·0	11·0	11·0	10·9	10·8	10·8
2·8	*Zubenelgenubi*	39	137	06·8	06·9	07·0	07·1	07·0	06·9	S 16	05·5	05·4	05·4	05·4	05·4	05·4
2·1	*Kochab*	40	137	19·4	20·0	20·5	20·9	21·1	20·9	N 74	06·7	06·7	06·7	06·5	06·3	06·1
2·4	ε Bootis		138	37·3	37·4	37·6	37·6	37·6	37·5	N 27	01·7	01·7	01·7	01·6	01·5	01·4
2·3	α Lupi		139	18·9	19·1	19·3	19·3	19·3	19·1	S 47	26·5	26·5	26·4	26·3	26·2	26·2
−0·3	*Rigil Kent.*	38	139	53·4	53·7	53·9	54·0	54·0	53·7	S 60	53·2	53·2	53·1	53·0	52·9	52·8
2·3	η Centauri		140	55·8	56·0	56·1	56·2	56·1	55·9	S 42	12·7	12·7	12·6	12·6	12·5	12·5
3·0	γ Bootis		141	51·5	51·7	51·8	51·9	51·9	51·8	N 38	15·7	15·7	15·6	15·5	15·4	15·2
0·0	*Arcturus*	37	145	56·9	57·0	57·1	57·1	57·1	56·9	N 19	07·4	07·5	07·4	07·4	07·2	07·1
2·1	*Menkent*	36	148	09·1	09·2	09·4	09·4	09·3	09·1	S 36	25·8	25·8	25·7	25·6	25·6	25·6
0·6	*Hadar*	35	148	49·7	50·0	50·2	50·3	50·2	49·9	S 60	26·0	26·0	25·9	25·8	25·7	25·6
2·6	ζ Centauri		150	55·6	55·8	55·9	55·9	55·8	55·6	S 47	21·0	20·9	20·9	20·8	20·7	20·7
2·7	η Bootis		151	11·2	11·3	11·4	11·4	11·4	11·2	N 18	20·5	20·5	20·5	20·4	20·3	20·1
1·9	*Alkaid*	34	152	59·8	60·0	60·2	60·3	60·2	60·0	N 49	15·5	15·5	15·4	15·3	15·1	15·0
2·3	ε Centauri		154	50·2	50·4	50·5	50·6	50·4	50·1	S 53	31·8	31·8	31·7	31·6	31·5	31·4
1·0	*Spica*	33	158	32·7	32·8	32·8	32·8	32·7	32·5	S 11	13·4	13·4	13·3	13·3	13·3	13·4
2·3	*Mizar*		158	54·0	54·2	54·4	54·4	54·3	54·1	N 54	52·1	52·1	52·0	51·8	51·6	51·5
2·8	ι Centauri		159	40·9	41·1	41·2	41·2	41·0	40·8	S 36	46·6	46·6	46·5	46·4	46·4	46·4
2·8	ε Virginis		164	18·5	18·6	18·7	18·6	18·5	18·3	N 10	53·8	53·9	53·8	53·8	53·7	53·6
2·9	*Cor Caroli*		165	51·3	51·5	51·5	51·5	51·4	51·2	N 38	15·5	15·5	15·4	15·3	15·1	15·0
1·8	*Alioth*	32	166	21·9	22·1	22·2	22·2	22·1	21·8	N 55	54·0	54·0	53·9	53·7	53·5	53·4
1·3	*Mimosa*		167	53·7	53·9	54·1	54·0	53·8	53·4	S 59	45·5	45·4	45·3	45·2	45·1	45·0
2·9	γ Virginis		169	26·1	26·2	26·2	26·2	26·1	25·9	S 1	30·8	30·8	30·8	30·8	30·9	31·0
2·2	*Muhlifain*		169	27·4	27·5	27·6	27·6	27·4	27·1	S 49	01·7	01·6	01·5	01·4	01·4	01·4
2·7	α Muscæ		170	31·5	31·9	32·1	32·0	31·7	31·2	S 69	12·3	12·3	12·1	12·0	11·9	11·9
2·7	β Corvi		171	14·9	14·9	15·0	15·0	14·8	14·6	S 23	27·8	27·8	27·7	27·7	27·7	27·7
1·6	*Gacrux*	31	172	02·6	02·8	02·9	02·9	02·6	02·3	S 57	11·0	10·9	10·8	10·7	10·6	10·6
1·3	*Acrux*	30	173	11·0	11·3	11·4	11·4	11·1	10·7	S 63	10·2	10·1	10·0	09·8	09·7	09·7
2·6	*Gienah*	29	175	53·8	53·9	53·9	53·9	53·7	53·5	S 17	36·5	36·5	36·4	36·4	36·4	36·5
2·6	δ Centauri		177	45·4	45·6	45·7	45·6	45·4	45·0	S 50	47·5	47·4	47·3	47·2	47·1	47·2
2·4	*Phecda*		181	23·5	23·6	23·7	23·6	23·4	23·0	N 53	38·0	37·9	37·8	37·6	37·4	37·3
2·1	*Denebola*	28	182	35·2	35·2	35·2	35·2	35·0	34·8	N 14	30·5	30·5	30·4	30·4	30·2	30·1
2·6	δ Leonis		191	19·1	19·1	19·1	19·0	18·8	18·6	N 20	27·6	27·6	27·6	27·5	27·4	27·3
3·0	ψ Ursæ Majoris		192	25·4	25·4	25·4	25·3	25·1	24·8	N 44	26·3	26·2	26·1	25·9	25·8	25·7
1·8	*Dubhe*	27	193	53·7	53·8	53·8	53·6	53·3	52·9	N 61	41·5	41·3	41·2	41·0	40·9	40·8
2·4	*Merak*		194	22·1	22·2	22·2	22·0	21·7	21·4	N 56	19·4	19·2	19·1	18·9	18·8	18·7
2·7	μ Velorum		198	11·0	11·1	11·1	10·9	10·7	10·3	S 49	29·2	29·1	28·9	28·8	28·8	28·9
2·8	θ Carinæ		199	09·7	09·8	09·8	09·6	09·2	08·8	S 64	27·6	27·5	27·4	27·2	27·2	27·2
2·3	*Algeiba*		204	50·9	50·9	50·8	50·7	50·4	50·2	N 19	47·0	46·9	46·9	46·8	46·7	46·6
1·4	*Regulus*	26	207	45·2	45·2	45·1	45·0	44·8	44·5	N 11	54·6	54·6	54·6	54·5	54·4	54·3
3·0	ε Leonis		213	22·4	22·4	22·3	22·2	21·9	21·7	N 23	43·2	43·2	43·2	43·1	43·0	42·9
3·1	*N* Velorum		217	06·7	06·8	06·7	06·4	06·0	05·7	S 57	05·4	05·2	05·1	05·0	05·0	05·1
2·0	*Alphard*	25	217	57·7	57·7	57·6	57·4	57·2	56·9	S 8	42·6	42·6	42·5	42·5	42·6	42·7
2·5	κ Velorum		219	23·2	23·3	23·1	22·9	22·5	22·2	S 55	03·8	03·7	03·5	03·5	03·5	03·6
2·2	ι Carinæ		220	39·4	39·4	39·3	39·0	38·6	38·3	S 59	19·7	19·5	19·4	19·3	19·3	19·4
1·7	*Miaplacidus*	24	221	40·9	41·0	40·8	40·4	39·9	39·4	S 69	46·1	46·0	45·8	45·7	45·7	45·8
2·2	*Suhail*	23	222	53·9	53·9	53·7	53·5	53·2	53·0	S 43	28·9	28·8	28·7	28·6	28·7	28·8
3·1	ι Ursæ Majoris		224	60·2	60·1	60·0	59·7	59·4	59·1	N 47	59·8	59·7	59·6	59·5	59·4	59·3
2·0	δ Velorum		228	45·0	45·0	44·8	44·6	44·2	43·9	S 54	45·3	45·1	45·0	44·9	44·9	45·1
1·9	*Avior*	22	234	19·2	19·2	19·0	18·7	18·3	18·0	S 59	33·0	32·8	32·7	32·6	32·7	32·8
1·8	γ Velorum		237	32·0	31·9	31·7	31·5	31·2	30·9	S 47	22·4	22·2	22·1	22·1	22·1	22·3
2·8	ρ Puppis		237	59·6	59·5	59·4	59·1	58·9	58·7	S 24	20·4	20·2	20·2	20·2	20·2	20·4
2·3	ζ Puppis		238	60·4	60·3	60·1	59·9	59·6	59·4	S 40	02·3	02·1	02·0	02·0	02·1	02·2
1·1	*Pollux*	21	243	29·7	29·6	29·4	29·2	28·9	28·7	N 27	59·8	59·8	59·8	59·7	59·7	59·6
0·4	*Procyon*	20	245	01·5	01·4	01·2	01·0	00·7	00·5	N 5	11·7	11·7	11·7	11·7	11·6	11·5

Mag.	Name and Number		SHA							Declination						
				JAN.	FEB.	MAR.	APR.	MAY	JUNE		JAN.	FEB.	MAR.	APR.	MAY	JUNE
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
1·6	α Geminorum		246	09·8	09·7	09·8	10·0	10·1	10·1	N 31	51·7	51·7	51·7	51·8	51·8	51·7
3·3	σ Puppis		247	35·6	35·7	35·8	36·0	36·2	36·3	S 43	19·5	19·7	19·8	19·8	19·8	19·7
2·9	β Canis Minoris		248	03·1	03·1	03·2	03·3	03·4	03·5	N 8	15·9	15·8	15·8	15·8	15·8	15·9
2·4	η Canis Majoris		248	51·4	51·4	51·5	51·7	51·8	51·9	S 29	19·6	19·7	19·8	19·8	19·8	19·7
2·7	π Puppis		250	36·4	36·4	36·6	36·7	36·9	37·0	S 37	07·2	07·3	07·4	07·4	07·4	07·3
1·8	δ Canis Majoris		252	46·8	46·8	46·9	47·1	47·2	47·3	S 26	24·8	24·9	25·0	25·0	24·9	24·9
3·0	ο Canis Majoris		254	07·1	07·1	07·3	07·4	07·5	07·6	S 23	51·1	51·2	51·3	51·3	51·2	51·2
1·5	ε Canis Majoris	19	255	13·5	13·5	13·7	13·8	14·0	14·0	S 28	59·4	59·5	59·6	59·6	59·5	59·4
2·9	τ Puppis		257	26·2	26·3	26·5	26·7	27·0	27·1	S 50	37·8	37·9	38·0	38·0	38·0	37·9
−1·5	α Canis Majoris	18	258	34·9	34·9	35·0	35·2	35·3	35·3	S 16	44·0	44·1	44·2	44·2	44·1	44·0
1·9	γ Geminorum		260	24·1	24·1	24·2	24·4	24·5	24·5	N 16	23·3	23·3	23·3	23·3	23·3	23·3
−0·7	α Carinæ	17	263	56·4	56·5	56·8	57·0	57·2	57·3	S 52	42·2	42·4	42·5	42·5	42·4	42·2
2·0	β Canis Majoris		264	11·6	11·7	11·8	11·9	12·0	12·1	S 17	57·8	57·9	58·0	58·0	57·9	57·8
2·6	θ Aurigæ		269	52·1	52·2	52·3	52·5	52·6	52·5	N 37	12·8	12·8	12·8	12·8	12·8	12·7
1·9	β Aurigæ		269	54·1	54·1	54·3	54·5	54·6	54·6	N 44	56·9	57·0	57·0	57·0	56·9	56·8
Var.‡	α Orionis	16	271	02·8	02·9	03·0	03·1	03·2	03·2	N 7	24·5	24·4	24·4	24·4	24·4	24·5
2·1	κ Orionis		272	55·2	55·3	55·4	55·5	55·6	55·6	S 9	40·1	40·1	40·2	40·1	40·1	40·0
1·9	ζ Orionis		274	39·7	39·7	39·9	40·0	40·1	40·0	S 1	56·3	56·4	56·4	56·4	56·3	56·3
2·6	α Columbæ		274	58·7	58·8	59·0	59·1	59·3	59·3	S 34	04·3	04·4	04·4	04·4	04·3	04·1
3·0	ζ Tauri		275	24·8	24·8	25·0	25·1	25·2	25·1	N 21	08·9	08·9	08·9	08·9	08·9	08·9
1·7	ε Orionis	15	275	47·8	47·9	48·0	48·1	48·2	48·2	S 1	11·8	11·8	11·9	11·8	11·8	11·8
2·8	ι Orionis		275	59·8	59·9	60·0	60·1	60·2	60·2	S 5	54·3	54·3	54·3	54·3	54·3	54·2
2·6	α Leporis		276	41·2	41·3	41·4	41·5	41·6	41·6	S 17	49·0	49·1	49·1	49·1	49·0	48·9
2·2	δ Orionis		276	50·9	50·9	51·0	51·2	51·2	51·2	S 0	17·5	17·6	17·6	17·6	17·6	17·5
2·8	β Leporis		277	48·7	48·8	48·9	49·0	49·1	49·1	S 20	45·2	45·3	45·3	45·3	45·2	45·1
1·7	β Tauri	14	278	14·5	14·5	14·7	14·8	14·9	14·8	N 28	37·0	37·0	37·0	37·0	37·0	36·9
1·6	γ Orionis	13	278	33·6	33·6	33·7	33·9	33·9	33·9	N 6	21·5	21·5	21·5	21·5	21·5	21·5
0·1	α Aurigæ	12	280	36·6	36·7	36·9	37·0	37·1	37·1	N 46	00·6	00·6	00·7	00·6	00·6	00·5
0·1	β Orionis	11	281	13·4	13·5	13·6	13·7	13·8	13·8	S 8	11·4	11·5	11·5	11·5	11·4	11·4
2·8	β Eridani		282	53·6	53·6	53·8	53·9	53·9	53·9	S 5	04·4	04·5	04·5	04·5	04·4	04·4
2·7	ι Aurigæ		285	33·6	33·7	33·8	34·0	34·0	33·9	N 33	11·1	11·1	11·1	11·0	11·0	11·0
0·9	α Tauri	10	290	51·1	51·2	51·3	51·4	51·4	51·4	N 16	31·9	31·9	31·9	31·9	31·8	31·9
2·9	ε Persei		300	20·4	20·5	20·7	20·8	20·8	20·7	N 40	02·7	02·7	02·7	02·6	02·5	02·5
3·0	γ Eridani		300	21·4	21·5	21·6	21·7	21·7	21·6	S 13	28·7	28·8	28·8	28·7	28·7	28·5
2·9	ζ Persei		301	17·0	17·1	17·2	17·3	17·3	17·2	N 31	55·1	55·1	55·1	55·0	55·0	55·0
2·9	η Tauri		302	57·3	57·4	57·5	57·6	57·6	57·5	N 24	08·4	08·4	08·4	08·4	08·3	08·3
1·8	α Persei	9	308	42·6	42·8	43·0	43·1	43·1	42·9	N 49	54·2	54·3	54·2	54·1	54·0	54·0
Var.§	β Persei		312	46·1	46·2	46·4	46·5	46·4	46·2	N 40	60·1	60·1	60·0	60·0	59·9	59·9
2·5	α Ceti	8	314	16·7	16·8	16·9	17·0	17·0	16·8	N 4	08·0	08·0	08·0	08·0	08·0	08·1
3·2	θ Eridani	7	315	19·4	19·6	19·8	19·9	19·9	19·7	S 40	15·8	15·8	15·8	15·7	15·5	15·4
2·0	α Ursæ Minoris		318	29·2	41·3	52·2	58·3	56·6	48·2	N 89	19·1	19·1	19·0	18·9	18·8	18·6
3·0	β Trianguli		327	26·5	26·7	26·8	26·8	26·7	26·5	N 35	02·6	02·6	02·5	02·4	02·4	02·4
2·0	α Arietis	6	328	02·7	02·8	02·9	02·9	02·8	02·6	N 23	31·0	31·0	31·0	30·9	30·9	30·9
2·3	γ Andromedæ		328	50·9	51·0	51·1	51·2	51·1	50·8	N 42	23·2	23·2	23·1	23·0	23·0	22·9
2·9	α Hydri		330	13·0	13·3	13·5	13·6	13·6	13·3	S 61	31·2	31·2	31·1	30·9	30·7	30·6
2·6	β Arietis		331	10·9	11·0	11·1	11·1	11·0	10·8	N 20	51·9	51·8	51·8	51·8	51·7	51·8
0·5	α Eridani	5	335	27·9	28·2	28·3	28·4	28·3	28·1	S 57	11·1	11·0	10·9	10·7	10·6	10·4
2·7	δ Cassiopeiæ		338	21·5	21·7	21·9	21·9	21·7	21·3	N 60	17·9	17·9	17·8	17·6	17·5	17·5
2·1	β Andromedæ		342	24·4	24·5	24·6	24·6	24·5	24·2	N 35	41·0	40·9	40·9	40·8	40·7	40·8
Var.‖	γ Cassiopeiæ		345	39·0	39·3	39·4	39·4	39·1	38·8	N 60	47·0	46·9	46·8	46·6	46·6	46·5
2·0	β Ceti	4	348	57·7	57·7	57·8	57·7	57·6	57·4	S 17	55·6	55·6	55·6	55·5	55·4	55·2
2·2	α Cassiopeiæ	3	349	42·7	42·9	43·0	43·0	42·7	42·4	N 56	36·2	36·2	36·0	35·9	35·8	35·8
2·4	α Phœnicis	2	353	17·4	17·6	17·6	17·6	17·4	17·2	S 42	14·9	14·9	14·7	14·6	14·4	14·3
2·8	β Hydri		353	25·5	26·0	26·3	26·2	25·8	25·2	S 77	11·7	11·6	11·5	11·3	11·1	11·0
2·8	γ Pegasi		356	32·8	32·8	32·8	32·8	32·6	32·4	N 15	14·8	14·8	14·8	14·7	14·8	14·8
2·3	β Cassiopeiæ		357	33·3	33·5	33·6	33·5	33·2	32·9	N 59	13·0	12·9	12·8	12·7	12·6	12·6
2·1	α Andromedæ	1	357	45·5	45·5	45·6	45·5	45·3	45·1	N 29	09·3	09·2	09·2	09·1	09·1	09·2

‡ 0·1 — 1·2 § 2·1 — 3·4 ‖ Irregular variable; 2009 mag. 2·1

Mag.	Name and Number		SHA							Declination						
				JULY	AUG.	SEPT.	OCT.	NOV.	DEC.		JULY	AUG.	SEPT.	OCT.	NOV.	DEC.
			°	′	′	′	′	′	′	°	′	′	′	′	′	′
1·6	*Castor*		246	10·1	09·9	09·7	09·5	09·2	09·0	N 31	51·7	51·7	51·6	51·6	51·5	51·5
3·3	σ Puppis		247	36·3	36·2	36·0	35·8	35·5	35·3	S 43	19·6	19·4	19·3	19·3	19·4	19·5
2·9	β Canis Minoris		248	03·4	03·3	03·1	02·9	02·7	02·5	N 8	15·9	15·9	15·9	15·9	15·8	15·8
2·4	η Canis Majoris		248	51·9	51·8	51·6	51·4	51·1	50·9	S 29	19·6	19·5	19·4	19·4	19·5	19·6
2·7	π Puppis		250	37·0	36·8	36·7	36·4	36·1	35·9	S 37	07·1	07·0	06·9	06·9	07·0	07·1
1·8	*Wezen*		252	47·2	47·1	46·9	46·7	46·5	46·3	S 26	24·7	24·6	24·6	24·6	24·6	24·8
3·0	*o* Canis Majoris		254	07·5	07·4	07·2	07·0	06·8	06·6	S 23	51·0	50·9	50·9	50·9	51·0	51·1
1·5	*Adhara*	19	255	14·0	13·8	13·6	13·4	13·2	13·0	S 28	59·3	59·2	59·1	59·1	59·2	59·3
2·9	τ Puppis		257	27·0	26·9	26·6	26·3	26·1	25·9	S 50	37·7	37·6	37·5	37·5	37·6	37·7
−1·5	*Sirius*	18	258	35·2	35·1	34·9	34·7	34·5	34·3	S 16	43·9	43·9	43·8	43·8	43·9	44·0
1·9	*Alhena*		260	24·4	24·2	24·0	23·8	23·5	23·4	N 16	23·3	23·3	23·3	23·3	23·2	23·2
−0·7	*Canopus*	17	263	57·3	57·1	56·8	56·5	56·2	56·1	S 52	42·1	41·9	41·9	41·9	42·0	42·1
2·0	*Mirzam*		264	12·0	11·8	11·6	11·4	11·2	11·0	S 17	57·7	57·6	57·6	57·6	57·7	57·8
2·6	θ Aurigæ		269	52·4	52·2	51·9	51·6	51·4	51·2	N 37	12·7	12·7	12·6	12·6	12·6	12·7
1·9	*Menkalinan*		269	54·4	54·2	53·9	53·6	53·3	53·1	N 44	56·8	56·7	56·7	56·7	56·7	56·8
Var.‡	*Betelgeuse*	16	271	03·1	02·9	02·7	02·5	02·2	02·1	N 7	24·5	24·6	24·6	24·6	24·5	24·5
2·1	κ Orionis		272	55·5	55·3	55·1	54·9	54·7	54·6	S 9	39·9	39·8	39·8	39·8	39·9	40·0
1·9	*Alnitak*		274	39·9	39·7	39·5	39·3	39·1	39·0	S 1	56·2	56·1	56·1	56·1	56·2	56·2
2·6	*Phact*		274	59·2	59·0	58·7	58·5	58·3	58·2	S 34	04·0	03·9	03·8	03·9	04·0	04·1
3·0	ζ Tauri		275	25·0	24·8	24·5	24·3	24·1	23·9	N 21	08·9	08·9	08·9	08·9	08·9	08·9
1·7	*Alnilam*	15	275	48·0	47·8	47·6	47·4	47·2	47·1	S 1	11·7	11·6	11·6	11·6	11·7	11·7
2·8	ι Orionis		275	60·1	59·9	59·7	59·5	59·3	59·1	S 5	54·1	54·1	54·0	54·0	54·1	54·2
2·6	α Leporis		276	41·5	41·3	41·1	40·9	40·7	40·6	S 17	48·8	48·7	48·7	48·7	48·8	48·9
2·2	δ Orionis		276	51·1	50·9	50·7	50·5	50·3	50·1	S 0	17·4	17·4	17·3	17·4	17·4	17·5
2·8	β Leporis		277	49·0	48·8	48·6	48·4	48·2	48·1	S 20	45·0	44·9	44·8	44·8	44·9	45·1
1·7	*Elnath*	14	278	14·7	14·4	14·2	13·9	13·7	13·6	N 28	36·9	36·9	36·9	37·0	37·0	37·0
1·6	*Bellatrix*	13	278	33·7	33·6	33·3	33·1	32·9	32·8	N 6	21·6	21·6	21·7	21·7	21·6	21·6
0·1	*Capella*	12	280	36·9	36·6	36·3	36·0	35·7	35·5	N 46	00·4	00·4	00·4	00·4	00·5	00·5
0·1	*Rigel*	11	281	13·6	13·4	13·2	13·0	12·8	12·7	S 8	11·3	11·2	11·2	11·2	11·2	11·3
2·8	β Eridani		282	53·7	53·6	53·3	53·1	53·0	52·8	S 5	04·3	04·2	04·2	04·2	04·2	04·3
2·7	ι Aurigæ		285	33·8	33·5	33·3	33·0	32·8	32·7	N 33	10·9	11·0	11·0	11·0	11·0	11·1
0·9	*Aldebaran*	10	290	51·2	51·0	50·7	50·5	50·3	50·2	N 16	31·9	31·9	32·0	32·0	32·0	32·0
2·9	ε Persei		300	20·4	20·1	19·9	19·6	19·4	19·3	N 40	02·5	02·5	02·5	02·6	02·7	02·7
3·0	γ Eridani		300	21·4	21·2	21·0	20·8	20·7	20·6	S 13	28·4	28·3	28·3	28·3	28·4	28·5
2·9	ζ Persei		301	17·0	16·7	16·5	16·3	16·1	16·0	N 31	55·0	55·0	55·1	55·1	55·2	55·2
2·9	*Alcyone*		302	57·3	57·0	56·8	56·6	56·5	56·4	N 24	08·4	08·4	08·5	08·5	08·6	08·6
1·8	*Mirfak*	9	308	42·6	42·2	41·9	41·7	41·5	41·4	N 49	53·9	54·0	54·1	54·1	54·3	54·3
Var.§	*Algol*		312	46·0	45·7	45·4	45·2	45·1	45·0	N 40	59·9	59·9	60·0	60·1	60·2	60·2
2·5	*Menkar*	8	314	16·6	16·4	16·2	16·0	15·9	15·9	N 4	08·2	08·2	08·3	08·3	08·3	08·2
3·2	*Acamar*	7	315	19·5	19·2	19·0	18·8	18·7	18·8	S 40	15·2	15·2	15·2	15·3	15·4	15·5
2·0	*Polaris*		317	95·3	80·6	67·2	57·4	53·2	57·0	N 89	18·6	18·6	18·7	18·8	19·0	19·2
3·0	β Trianguli		327	26·2	26·0	25·7	25·6	25·5	25·5	N 35	02·4	02·5	02·6	02·7	02·8	02·8
2·0	*Hamal*	6	328	02·4	02·1	01·9	01·8	01·7	01·7	N 23	31·0	31·1	31·2	31·2	31·3	31·3
2·3	*Almak*		328	50·5	50·2	50·0	49·9	49·8	49·8	N 42	23·0	23·1	23·2	23·3	23·4	23·5
2·9	α Hydri		330	13·0	12·6	12·3	12·1	12·1	12·3	S 61	30·4	30·4	30·5	30·6	30·8	30·9
2·6	*Sheratan*		331	10·5	10·3	10·1	10·0	09·9	10·0	N 20	51·9	52·0	52·0	52·1	52·1	52·1
0·5	*Achernar*	5	335	27·7	27·4	27·1	27·0	27·0	27·2	S 57	10·3	10·3	10·3	10·5	10·6	10·7
2·7	*Ruchbah*		338	20·9	20·5	20·2	20·1	20·0	20·2	N 60	17·5	17·6	17·8	17·9	18·1	18·2
2·1	*Mirach*		342	23·9	23·7	23·5	23·4	23·4	23·4	N 35	40·8	41·0	41·1	41·2	41·3	41·3
Var.‖	γ Cassiopeiæ		345	38·3	38·0	37·7	37·6	37·6	37·8	N 60	46·6	46·7	46·9	47·0	47·2	47·3
2·0	*Diphda*	4	348	57·2	56·9	56·8	56·7	56·8	56·8	S 17	55·1	55·1	55·1	55·1	55·2	55·3
2·2	*Schedar*	3	349	42·0	41·7	41·5	41·4	41·4	41·6	N 56	35·9	36·0	36·2	36·3	36·5	36·5
2·4	*Ankaa*	2	353	16·9	16·6	16·5	16·4	16·5	16·6	S 42	14·2	14·2	14·3	14·4	14·5	14·6
2·8	β Hydri		353	24·4	23·7	23·2	23·2	23·6	24·2	S 77	10·9	11·0	11·1	11·2	11·4	11·4
2·8	*Algenib*		356	32·1	31·9	31·8	31·8	31·8	31·9	N 15	14·9	15·1	15·1	15·2	15·2	15·2
2·3	*Caph*		357	32·5	32·1	32·0	31·9	32·0	32·2	N 59	12·7	12·8	13·0	13·2	13·3	13·3
2·1	*Alpheratz*	1	357	44·8	44·6	44·5	44·4	44·5	44·5	N 29	09·3	09·4	09·5	09·6	09·7	09·7

‡ 0·1 — 1·2 § 2·1 — 3·4 ‖ Irregular variable; 2009 mag. 2·1

POLARIS (POLE STAR) TABLES, 2011

FOR DETERMINING LATITUDE FROM SEXTANT ALTITUDE AND FOR AZIMUTH

LHA ARIES	0° – 9°	10° – 19°	20° – 29°	30° – 39°	40° – 49°	50° – 59°	60° – 69°	70° – 79°	80° – 89°	90° – 99°	100° – 109°	110° – 119°
	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0
°	′	′	′	′	′	′	′	′	′	′	′	′
0	0 28·2	0 23·9	0 20·6	0 18·5	0 17·7	0 18·2	0 19·8	0 22·7	0 26·7	0 31·7	0 37·5	0 43·9
1	27·7	23·5	20·4	18·4	17·7	18·3	20·1	23·1	27·2	32·2	38·1	44·6
2	27·2	23·1	20·1	18·3	17·7	18·4	20·3	23·4	27·6	32·8	38·7	45·3
3	26·8	22·8	19·9	18·2	17·7	18·5	20·6	23·8	28·1	33·4	39·4	46·0
4	26·3	22·4	19·6	18·1	17·7	18·7	20·9	24·2	28·6	33·9	40·0	46·7
5	0 25·9	0 22·1	0 19·4	0 18·0	0 17·8	0 18·8	0 21·1	0 24·6	0 29·1	0 34·5	0 40·7	0 47·4
6	25·5	21·8	19·2	17·9	17·8	19·0	21·4	25·0	29·6	35·1	41·3	48·0
7	25·0	21·5	19·0	17·8	17·9	19·2	21·7	25·4	30·1	35·7	42·0	48·7
8	24·6	21·2	18·9	17·8	18·0	19·4	22·1	25·8	30·6	36·3	42·6	49·4
9	24·2	20·9	18·7	17·7	18·1	19·6	22·4	26·3	31·2	36·9	43·3	50·1
10	0 23·9	0 20·6	0 18·5	0 17·7	0 18·2	0 19·8	0 22·7	0 26·7	0 31·7	0 37·5	0 43·9	0 50·8
Lat.	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1
°	′	′	′	′	′	′	′	′	′	′	′	′
0	0·5	0·5	0·6	0·6	0·6	0·6	0·6	0·5	0·5	0·4	0·4	0·3
10	·5	·6	·6	·6	·6	·6	·6	·5	·5	·4	·4	·4
20	·5	·6	·6	·6	·6	·6	·6	·5	·5	·5	·4	·4
30	·5	·6	·6	·6	·6	·6	·6	·6	·5	·5	·5	·5
40	0·6	0·6	0·6	0·6	0·6	0·6	0·6	0·6	0·6	0·5	0·5	0·5
45	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
50	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
55	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·7
60	·6	·6	·6	·6	·6	·6	·6	·6	·7	·7	·7	·7
62	0·7	0·6	0·6	0·6	0·6	0·6	0·6	0·7	0·7	0·7	0·7	0·8
64	·7	·6	·6	·6	·6	·6	·6	·7	·7	·7	·8	·8
66	·7	·7	·6	·6	·6	·6	·6	·7	·7	·8	·8	·8
68	0·7	0·7	0·6	0·6	0·6	0·6	0·6	0·7	0·7	0·8	0·9	0·9
Month	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2
	′	′	′	′	′	′	′	′	′	′	′	′
Jan.	0·7	0·8	0·8	0·8	0·8	0·8	0·8	0·8	0·8	0·7	0·7	0·7
Feb.	·7	·7	·8	·8	·8	·8	·9	·9	·9	·9	·9	·8
Mar.	·5	·6	·6	·7	·8	·8	·9	·9	·9	·9	·9	0·9
Apr.	0·4	0·4	0·5	0·6	0·6	0·7	0·8	0·8	0·9	0·9	0·9	1·0
May	·3	·3	·4	·4	·5	·5	·6	·7	·7	·8	·9	0·9
June	·2	·2	·3	·3	·3	·4	·5	·5	·6	·7	·7	·8
July	0·3	0·3	0·3	0·3	0·3	0·3	0·4	0·4	0·4	0·5	0·6	0·6
Aug.	·4	·4	·3	·3	·3	·3	·3	·3	·3	·4	·4	·5
Sept.	·6	·5	·5	·4	·4	·4	·3	·3	·3	·3	·3	·3
Oct.	0·8	0·7	0·6	0·6	0·5	0·5	0·4	0·4	0·3	0·3	0·3	0·3
Nov.	0·9	0·9	0·8	·8	·7	·6	·6	·5	·4	·4	·3	·3
Dec.	1·0	1·0	1·0	0·9	0·9	0·8	0·7	0·7	0·6	0·5	0·4	0·4
Lat.	AZIMUTH											
°	°	°	°	°	°	°	°	°	°	°	°	°
0	0·4	0·3	0·2	0·1	0·0	359·8	359·7	359·6	359·5	359·4	359·4	359·3
20	0·4	0·3	0·2	0·1	0·0	359·8	359·7	359·6	359·5	359·4	359·3	359·3
40	0·5	0·4	0·3	0·1	359·9	359·8	359·6	359·5	359·4	359·3	359·2	359·1
50	0·6	0·5	0·3	0·1	359·9	359·7	359·6	359·4	359·3	359·1	359·0	359·0
55	0·7	0·5	0·3	0·1	359·9	359·7	359·5	359·3	359·2	359·0	358·9	358·8
60	0·8	0·6	0·4	0·2	359·9	359·7	359·4	359·2	359·0	358·9	358·8	358·7
65	1·0	0·7	0·5	0·2	359·9	359·6	359·3	359·1	358·9	358·7	358·5	358·4

Latitude = Apparent altitude (corrected for refraction) $-1° + a_0 + a_1 + a_2$

The table is entered with LHA Aries to determine the column to be used; each column refers to a range of 10°. a_0 is taken, with mental interpolation, from the upper table with the units of LHA Aries in degrees as argument; a_1, a_2 are taken, without interpolation, from the second and third tables with arguments latitude and month respectively. a_0, a_1, a_2, are always positive. The final table gives the azimuth of *Polaris*.

LHA ARIES	120° – 129°	130° – 139°	140° – 149°	150° – 159°	160° – 169°	170° – 179°	180° – 189°	190° – 199°	200° – 209°	210° – 219°	220° – 229°	230° – 239°
	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0
°	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
0	0 50·8	0 58·0	1 05·1	1 12·1	1 18·6	1 24·5	1 29·7	1 33·9	1 37·1	1 39·1	1 39·9	1 39·5
1	51·5	58·7	05·8	12·7	19·2	25·1	30·1	34·3	37·3	39·2	39·9	39·4
2	52·3	0 59·4	06·5	13·4	19·8	25·6	30·6	34·6	37·6	39·3	39·9	39·2
3	53·0	1 00·1	07·2	14·1	20·4	26·2	31·0	35·0	37·8	39·4	39·9	39·1
4	53·7	00·8	07·9	14·7	21·1	26·7	31·5	35·3	38·0	39·5	39·9	38·9
5	0 54·4	1 01·6	1 08·6	1 15·4	1 21·6	1 27·2	1 31·9	1 35·6	1 38·2	1 39·6	1 39·8	1 38·8
6	55·1	02·3	09·3	16·0	22·2	27·7	32·3	35·9	38·4	39·7	39·8	38·6
7	55·8	03·0	10·0	16·7	22·8	28·2	32·7	36·2	38·6	39·8	39·7	38·4
8	56·5	03·7	10·7	17·3	23·4	28·7	33·1	36·5	38·8	39·8	39·6	38·2
9	57·3	04·4	11·4	18·0	24·0	29·2	33·5	36·8	38·9	39·9	39·6	38·0
10	0 58·0	1 05·1	1 12·1	1 18·6	1 24·5	1 29·7	1 33·9	1 37·1	1 39·1	1 39·9	1 39·5	1 37·8
Lat.	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1
°	′	′	′	′	′	′	′	′	′	′	′	′
0	0·3	0·3	0·3	0·4	0·4	0·4	0·5	0·5	0·6	0·6	0·6	0·6
10	·4	·4	·4	·4	·4	·5	·5	·6	·6	·6	·6	·6
20	·4	·4	·4	·4	·5	·5	·5	·6	·6	·6	·6	·6
30	·5	·4	·5	·5	·5	·5	·5	·6	·6	·6	·6	·6
40	0·5	0·5	0·5	0·5	0·5	0·6	0·6	0·6	0·6	0·6	0·6	0·6
45	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
50	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
55	·7	·7	·7	·6	·6	·6	·6	·6	·6	·6	·6	·6
60	·7	·7	·7	·7	·7	·7	·6	·6	·6	·6	·6	·6
62	0·8	0·8	0·8	0·7	0·7	0·7	0·7	0·6	0·6	0·6	0·6	0·6
64	·8	·8	·8	·8	·7	·7	·7	·6	·6	·6	·6	·6
66	·9	·9	·8	·8	·8	·7	·7	·7	·6	·6	·6	·6
68	0·9	0·9	0·9	0·9	0·8	0·8	0·7	0·7	0·6	0·6	0·6	0·6
Month	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2
	′	′	′	′	′	′	′	′	′	′	′	′
Jan.	0·7	0·6	0·6	0·6	0·5	0·5	0·5	0·4	0·4	0·4	0·4	0·4
Feb.	·8	·8	·7	·7	·6	·6	·5	·5	·4	·4	·4	·4
Mar.	0·9	0·9	0·9	0·8	·8	·7	·7	·6	·6	·5	·4	·4
Apr.	1·0	1·0	1·0	1·0	0·9	0·9	0·8	0·8	0·7	0·6	0·6	0·5
May	0·9	1·0	1·0	1·0	1·0	1·0	0·9	0·9	·8	·8	·7	·7
June	·8	0·9	0·9	1·0	1·0	1·0	1·0	1·0	·9	·9	·9	·8
July	0·7	0·7	0·8	0·8	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·9
Aug.	·5	·6	·6	·7	·7	·8	·8	·8	·9	·9	·9	·9
Sept.	·4	·4	·4	·5	·5	·6	·6	·7	·7	·8	·8	·8
Oct.	0·3	0·3	0·3	0·3	0·3	0·4	0·4	0·5	0·6	0·6	0·7	0·7
Nov.	·2	·2	·2	·2	·2	·2	·3	·3	·4	·4	·5	·6
Dec.	0·3	0·2	0·2	0·2	0·1	0·1	0·2	0·2	0·2	0·3	0·3	0·4
Lat.	AZIMUTH											
°	°	°	°	°	°	°	°	°	°	°	°	°
0	359·3	359·3	359·3	359·4	359·4	359·5	359·6	359·7	359·8	359·9	0·0	0·2
20	359·3	359·3	359·3	359·3	359·4	359·5	359·6	359·7	359·8	359·9	0·0	0·2
40	359·1	359·1	359·1	359·2	359·3	359·4	359·5	359·6	359·7	359·9	0·1	0·2
50	358·9	358·9	359·0	359·0	359·1	359·2	359·4	359·5	359·7	359·9	0·1	0·2
55	358·8	358·8	358·8	358·9	359·0	359·1	359·3	359·5	359·7	359·9	0·1	0·3
60	358·6	358·6	358·7	358·8	358·9	359·0	359·2	359·4	359·6	359·8	0·1	0·3
65	358·4	358·4	358·4	358·5	358·7	358·8	359·1	359·3	359·5	359·8	0·1	0·4

ILLUSTRATION

On 2011 April 21 at $23^h\ 18^m\ 56^s$ UT in longitude W 37° 14′ the apparent altitude (corrected for refraction), H_O, of *Polaris* was 49° 31′·6

From the daily pages:	° ′
GHA Aries (23^h)	194 40·1
Increment ($18^m\ 56^s$)	4 44·8
Longitude (west)	−37 14
LHA Aries	162 11

	° ′
H_O	49 31·6
a_0 (argument 162° 11′)	1 19·9
a_1 (Lat 50° approx.)	0·6
a_2 (April)	0·9
Sum − 1° = Lat =	49 53·0

POLARIS (POLE STAR) TABLES, 2011

FOR DETERMINING LATITUDE FROM SEXTANT ALTITUDE AND FOR AZIMUTH

LHA ARIES	240° – 249°	250° – 259°	260° – 269°	270° – 279°	280° – 289°	290° – 299°	300° – 309°	310° – 319°	320° – 329°	330° – 339°	340° – 349°	350° – 359°
	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0	a_0
	′	′	′	′	′	′	′	′	′	′	′	′
0	1 37·8	1 35·0	1 31·1	1 26·2	1 20·5	1 14·2	1 07·3	1 00·2	0 53·1	0 46·1	0 39·5	0 33·4
1	37·6	34·7	30·7	25·7	19·9	13·5	06·6	0 59·5	52·3	45·4	38·8	32·9
2	37·3	34·3	30·2	25·2	19·3	12·8	05·9	58·8	51·6	44·7	38·2	32·3
3	37·1	33·9	29·7	24·6	18·7	12·1	05·2	58·1	50·9	44·0	37·6	31·8
4	36·8	33·6	29·3	24·0	18·1	11·5	04·5	57·3	50·2	43·4	37·0	31·2
5	1 36·6	1 33·2	1 28·8	1 23·5	1 17·4	1 10·8	1 03·8	0 56·6	0 49·5	0 42·7	0 36·4	0 30·7
6	36·3	32·8	28·3	22·9	16·8	10·1	03·1	55·9	48·8	42·0	35·8	30·2
7	36·0	32·4	27·8	22·3	16·1	09·4	02·4	55·2	48·1	41·4	35·2	29·7
8	35·7	32·0	27·3	21·7	15·5	08·7	01·6	54·5	47·4	40·7	34·6	29·2
9	35·3	31·5	26·8	21·1	14·8	08·0	00·9	53·8	46·8	40·1	34·0	28·7
10	1 35·0	1 31·1	1 26·2	1 20·5	1 14·2	1 07·3	1 00·2	0 53·1	0 46·1	0 39·5	0 33·4	0 28·2
Lat.	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1	a_1
	′	′	′	′	′	′	′	′	′	′	′	′
0	0·6	0·5	0·5	0·4	0·4	0·3	0·3	0·3	0·3	0·4	0·4	0·4
10	·6	·5	·5	·4	·4	·4	·4	·4	·4	·4	·4	·5
20	·6	·5	·5	·5	·4	·4	·4	·4	·4	·4	·5	·5
30	·6	·6	·5	·5	·5	·5	·5	·4	·5	·5	·5	·5
40	0·6	0·6	0·6	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·5	0·6
45	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
50	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6	·6
55	·6	·6	·6	·6	·6	·7	·7	·7	·7	·6	·6	·6
60	·6	·6	·7	·7	·7	·7	·7	·7	·7	·7	·7	·7
62	0·6	0·7	0·7	0·7	0·7	0·8	0·8	0·8	0·8	0·7	0·7	0·7
64	·6	·7	·7	·7	·8	·8	·8	·8	·8	·8	·7	·7
66	·6	·7	·7	·8	·8	·8	·9	·9	·8	·8	·8	·7
68	0·6	0·7	0·7	0·8	0·9	0·9	0·9	0·9	0·9	0·9	0·8	0·8
Month	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2	a_2
	′	′	′	′	′	′	′	′	′	′	′	′
Jan.	0·4	0·4	0·4	0·5	0·5	0·5	0·5	0·6	0·6	0·6	0·7	0·7
Feb.	·3	·3	·3	·3	·3	·4	·4	·4	·5	·5	·6	·6
Mar.	·3	·3	·3	·3	·3	·3	·3	·3	·3	·4	·4	·5
Apr.	0·4	0·4	0·3	0·3	0·3	0·2	0·2	0·2	0·2	0·2	0·3	0·3
May	·6	·5	·5	·4	·3	·3	·3	·2	·2	·2	·2	·2
June	·7	·7	·6	·5	·5	·4	·4	·3	·3	·2	·2	·2
July	0·8	0·8	0·8	0·7	0·6	0·6	0·5	0·5	0·4	0·4	0·3	0·3
Aug.	·9	·9	·9	·8	·8	·7	·7	·6	·6	·5	·5	·4
Sept.	·9	·9	·9	·9	·9	·9	·8	·8	·8	·7	·7	·6
Oct.	0·8	0·8	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·9	0·8
Nov.	·6	·7	·8	·8	·9	·9	1·0	1·0	1·0	1·0	1·0	1·0
Dec.	0·5	0·5	0·6	0·7	0·8	0·8	0·9	1·0	1·0	1·0	1·1	1·1
Lat.	AZIMUTH											
	°	°	°	°	°	°	°	°	°	°	°	°
0	0·3	0·4	0·5	0·6	0·6	0·7	0·7	0·7	0·7	0·6	0·6	0·5
20	0·3	0·4	0·5	0·6	0·7	0·7	0·7	0·7	0·7	0·7	0·6	0·5
40	0·4	0·5	0·6	0·7	0·8	0·9	0·9	0·9	0·9	0·8	0·8	0·7
50	0·4	0·6	0·7	0·8	0·9	1·0	1·1	1·1	1·0	1·0	0·9	0·8
55	0·5	0·6	0·8	0·9	1·1	1·1	1·2	1·2	1·2	1·1	1·0	0·9
60	0·5	0·7	0·9	1·1	1·2	1·3	1·4	1·4	1·3	1·3	1·2	1·0
65	0·6	0·9	1·1	1·3	1·4	1·5	1·6	1·6	1·6	1·5	1·4	1·2

Latitude = Apparent altitude (corrected for refraction) $-1^\circ + a_0 + a_1 + a_2$

The table is entered with LHA Aries to determine the column to be used; each column refers to a range of 10°. a_0 is taken, with mental interpolation, from the upper table with the units of LHA Aries in degrees as argument; a_1, a_2 are taken, without interpolation, from the second and third tables with arguments latitude and month respectively. a_0, a_1, a_2, are always positive. The final table gives the azimuth of *Polaris*.

SIGHT REDUCTION PROCEDURES

METHODS AND FORMULAE FOR DIRECT COMPUTATION

1. *Introduction.* In this section formulae and methods are provided for *calculating* position at sea from observed altitudes taken with a marine sextant using a computer or programmable calculator.

The method uses analogous concepts and similar terminology as that used in *manual* methods of astro-navigation, where position is found by plotting position lines from their intercept and azimuth on a marine chart.

The algorithms are presented in standard algebra suitable for translating into the programming language of the user's computer. The basic ephemeris data may be taken directly from the main tabular pages of a current version of *The Nautical Almanac.* Formulae are given for calculating altitude and azimuth from the *GHA* and *Dec* of a body, and the estimated position of the observer. Formulae are also given for reducing sextant observations to observed altitudes by applying the corrections for dip, refraction, parallax and semi-diameter.

The intercept and azimuth obtained from each observation determine a position line, and the observer should lie on or close to each position line. The method of least squares is used to calculate the fix by finding the position where the sum of the squares of the distances from the position lines is a minimum. The use of least squares has other advantages. For example it is possible to improve the estimated position at the time of fix by repeating the calculation. It is also possible to include more observations in the solution and to reject doubtful ones.

2. *Notation.*

GHA = Greenwich hour angle. The range of GHA is from 0° to 360° starting at 0° on the Greenwich meridian increasing to the west, back to 360° on the Greenwich meridian.

SHA = sidereal hour angle. The range is 0° to 360°.

Dec = declination. The sign convention for declination is north is positive, south is negative. The range is from −90° at the south celestial pole to +90° at the north celestial pole.

$Long$ = longitude. The sign convention is east is positive, west is negative. The range is −180° to +180°.

Lat = latitude. The sign convention is north is positive, south is negative. The range is from −90° to +90°.

LHA = $GHA + Long$ = local hour angle. The LHA increases to the west from 0° on the local meridian to 360°.

H_C = calculated altitude. Above the horizon is positive, below the horizon is negative. The range is from −90° in the nadir to +90° in the zenith.

H_S = sextant altitude.

H = apparent altitude = sextant altitude corrected for instrumental error and dip.

H_O = observed altitude = apparent altitude corrected for refraction and, in appropriate cases, corrected for parallax and semi-diameter.

Z = Z_n = true azimuth. Z is measured from true north through east, south, west and back to north. The range is from 0° to 360°.

I = sextant index error.

D = dip of horizon.

R = atmospheric refraction.

HP = horizontal parallax of the Sun, Moon, Venus or Mars.
PA = parallax in altitude of the Sun, Moon, Venus or Mars.
S = semi-diameter of the Sun or Moon.
p = intercept = $H_O - H_C$. Towards is positive, away is negative.
T = course or track, measured as for azimuth from the north.
V = speed in knots.

3. *Entering Basic Data.* When quantities such as *GHA* are entered, which in *The Nautical Almanac* are given in degrees and minutes, convert them to degrees and decimals of a degree by dividing the minutes by 60 and adding to the degrees; for example, if $GHA = 123^\circ\ 45'.6$, enter the two numbers 123 and 45·6 into the memory and set $GHA = 123 + 45{\cdot}6/60 = 123^\circ.7600$. Although four decimal places of a degree are shown in the examples, it is assumed that full precision is maintained in the calculations.

When using a computer or programmable calculator, write a subroutine to convert degrees and minutes to degrees and decimals. Scientific calculators usually have a special key for this purpose. For quantities like *Dec* which require a minus sign for southern declination, change the sign from plus to minus after the value has been converted to degrees and decimals, *e.g.* $Dec = \text{S}\,0^\circ\ 12'.3 = \text{S}\,0^\circ.2050 = -0^\circ.2050$. Other quantities which require conversion are semi-diameter, horizontal parallax, longitude and latitude.

4. *Interpolation of GHA and Dec* The *GHA* and *Dec* of the Sun, Moon and planets are interpolated to the time of observation by direct calculation as follows: If the universal time is $a^h\ b^m\ c^s$, form the interpolation factor $x = b/60 + c/3600$. Enter the tabular value GHA_0 for the preceding hour (a) and the tabular value GHA_1 for the following hour ($a + 1$) then the interpolated value *GHA* is given by

$$GHA = GHA_0 + x(GHA_1 - GHA_0)$$

If the *GHA* passes through 360° between tabular values add 360° to GHA_1 before interpolation. If the interpolated value exceeds 360°, subtract 360° from *GHA*.

Similarly for declination, enter the tabular value Dec_0 for the preceding hour (a) and the tabular value Dec_1 for the following hour ($a + 1$), then the interpolated value *Dec* is given by

$$Dec = Dec_0 + x(Dec_1 - Dec_0)$$

5. *Example.* (a) Find the *GHA* and *Dec* of the Sun on 2011 February 10 at $14^h\ 47^m\ 13^s$ UT.

The interpolation factor $x = 47/60 + 13/3600 = 0^h.7869$

page 37 $14^h\ GHA_0 = 26^\circ\ 26'.8 = 26^\circ.4467$

$15^h\ GHA_1 = 41^\circ\ 26'.8 = 41^\circ.4467$

$14^h.7869\ GHA = 26{\cdot}4467 + 0{\cdot}7869(41{\cdot}4467 - 26{\cdot}4467) = 38^\circ.2508$

$14^h\ Dec_0 = \text{S}\,14^\circ\ 20'.5 = -14^\circ.3417$

$15^h\ Dec_1 = \text{S}\,14^\circ\ 19'.7 = -14^\circ.3283$

$14^h.7869\ Dec = -14{\cdot}3417 + 0{\cdot}7869(-14{\cdot}3283 + 14{\cdot}3417) = -14^\circ.3312$

GHA Aries is interpolated in the same way as *GHA* of a body. For a star the *SHA* and *Dec* are taken from the tabular page and do not require interpolation, then

$$GHA = GHA\ \text{Aries} + SHA$$

where *GHA* Aries is interpolated to the time of observation.

(b) Find the *GHA* and *Dec* of *Vega* on 2011 February 10 at $14^h\ 47^m\ 13^s$ UT.

The interpolation factor $x = 0^h.7869$ as in the previous example

page 36 14^h *GHA* Aries$_0$ $= 350°\ 18'.3 = 350°.3050$

15^h *GHA* Aries$_1$ $= 5°\ 20'.7 = 365°.3450$ (360° added)

$14^h.7869$ *GHA* Aries $= 350{\cdot}3050 + 0{\cdot}7869(365{\cdot}3450 - 350{\cdot}3050) = 362°.1406$

SHA $= 80°\ 40'.4 = 80°.6733$

GHA $=$ *GHA* Aries $+$ *SHA* $= 82°.8140$ (multiple of 360° removed)

Dec $= \text{N}\ 38°\ 47'.5 = +38°.7917$

6. *The calculated altitude and azimuth.* The calculated altitude H_C and true azimuth Z are determined from the *GHA* and *Dec* interpolated to the time of observation and from the *Long* and *Lat* estimated at the time of observation as follows:

Step 1. Calculate the local hour angle

$$LHA = GHA + Long$$

Add or subtract multiples of 360° to set *LHA* in the range 0° to 360°.

Step 2. Calculate S, C and the altitude H_C from

$$S = \sin Dec$$
$$C = \cos Dec \cos LHA$$
$$H_C = \sin^{-1}(S \sin Lat + C \cos Lat)$$

where $\sin^{-1}$ is the inverse function of sine.

Step 3. Calculate X and A from

$$X = (S \cos Lat - C \sin Lat)/\cos H_C$$
$$\text{If } X > +1 \quad \text{set} \quad X = +1$$
$$\text{If } X < -1 \quad \text{set} \quad X = -1$$
$$A = \cos^{-1} X$$

where $\cos^{-1}$ is the inverse function of cosine.

Step 4. Determine the azimuth Z

$$\text{If } LHA > 180° \quad \text{then} \quad Z = A$$
$$\text{Otherwise} \quad Z = 360° - A$$

7. *Example.* Find the calculated altitude H_C and azimuth Z when

$$GHA = 53° \quad Dec = \text{S}\ 15° \quad Lat = \text{N}\ 32° \quad Long = \text{W}\ 16°$$

For the calculation

$$GHA = 53°.0000 \quad Dec = -15°.0000 \quad Lat = +32°.0000 \quad Long = -16°.0000$$

Step 1. $LHA = 53{\cdot}0000 - 16{\cdot}0000 = 37{\cdot}0000$

Step 2. $S = -0{\cdot}2588$

$C = +0{\cdot}9659 \times 0{\cdot}7986 = 0{\cdot}7714$

$\sin H_C = -0{\cdot}2588 \times 0{\cdot}5299 + 0{\cdot}7714 \times 0{\cdot}8480 = 0{\cdot}5171$

$H_C = 31°.1346$

Step 3. $X = (-0{\cdot}2588 \times 0{\cdot}8480 - 0{\cdot}7714 \times 0{\cdot}5299)/0{\cdot}8560 = -0{\cdot}7340$

$A = 137°{\cdot}2239$

Step 4. Since $LHA \leq 180°$ then $Z = 360° - A = 222°{\cdot}7761$

8. *Reduction from sextant altitude to observed altitude.* The sextant altitude H_S is corrected for both dip and index error to produce the apparent altitude. The observed altitude H_O is calculated by applying a correction for refraction. For the Sun, Moon, Venus and Mars a correction for parallax is also applied to H, and for the Sun and Moon a further correction for semi-diameter is required. The corrections are calculated as follows:

Step 1. Calculate dip

$$D = 0°{\cdot}0293\sqrt{h}$$

where h is the height of eye above the horizon in metres.

Step 2. Calculate apparent altitude

$$H = H_S + I - D$$

where I is the sextant index error.

Step 3. Calculate refraction (R) at a standard temperature of 10° Celsius (C) and pressure of 1010 millibars (mb)

$$R_0 = 0°{\cdot}0167/\tan(H + 7{\cdot}32/(H + 4{\cdot}32))$$

If the temperature $T°$ C and pressure P mb are known calculate the refraction from

$$R = fR_0 \quad \text{where} \quad f = 0{\cdot}28P/(T + 273)$$

otherwise set $R = R_0$

Step 4. Calculate the parallax in altitude (PA) from the horizontal parallax (HP) and the apparent altitude (H) for the Sun, Moon, Venus and Mars as follows:

$$PA = HP\cos H$$

For the Sun $HP = 0°{\cdot}0024$. This correction is very small and could be ignored.

For the Moon HP is taken for the nearest hour from the main tabular page and converted to degrees.

For Venus and Mars the HP is taken from the critical table at the bottom of page 259 and converted to degrees.

For the navigational stars and the remaining planets, Jupiter and Saturn set $PA = 0$.

If an error of 0′.2 is significant the expression for the parallax in altitude for the Moon should include a small correction OB for the oblateness of the Earth as follows:

$$PA = HP\cos H + OB$$

where $OB = -0°{\cdot}0032\sin^2 Lat\cos H + 0°{\cdot}0032\sin(2Lat)\cos Z\sin H$

At mid-latitudes and for altitudes of the Moon below 60° a simple approximation to OB is

$$OB = -0°{\cdot}0017\cos H$$

Step 5. Calculate the semi-diameter for the Sun and Moon as follows:

Sun: S is taken from the main tabular page and converted to degrees.

Moon: $S = 0°{\cdot}2724HP$ where HP is taken for the nearest hour from the main tabular page and converted to degrees.

Step 6. Calculate the observed altitude

$$H_O = H - R + PA \pm S$$

where the plus sign is used if the lower limb of the Sun or Moon was observed and the minus sign if the upper limb was observed.

9. *Example.* The following example illustrates how to use a calculator to reduce the sextant altitude (H_S) to observed altitude (H_O); the sextant altitudes given are assumed to be taken on 2011 June 28 with a marine sextant, zero index error, at height 5·4 m, temperature −3° C and pressure 982 mb, the Moon sights are assumed to be taken at 10^h UT.

Body limb	Sun lower	Sun upper	Moon lower	Moon upper	Venus —	*Polaris* —
Sextant altitude: H_S	21·3283	3·3367	33·4600	26·1117	4·5433	49·6083
Step 1. Dip: $D = 0{\cdot}0293\sqrt{h}$	0·0681	0·0681	0·0681	0·0681	0·0681	0·0681
Step 2. Apparent altitude: $H = H_S + I - D$	21·2602	3·2686	33·3919	26·0436	4·4752	49·5402
Step 3. Refraction:						
R_0	0·0423	0·2256	0·0251	0·0338	0·1798	0·0142
f	1·0184	1·0184	1·0184	1·0184	1·0184	1·0184
$R = fR_0$	0·0431	0·2298	0·0256	0·0344	0·1831	0·0144
Step 4. Parallax:			(55′·6)	(55′·6)	(0′·1)	
HP	0·0024	0·0024	0·9267	0·9267	0·0017	—
Parallax in altitude: $PA = HP\cos H$	0·0022	0·0024	0·7737	0·8326	0·0017	—
Step 5. Semi-diameter:						
Sun : $S = 15{\cdot}8/60$	0·2633	0·2633	—	—	—	—
Moon : $S = 0{\cdot}2724HP$	—	—	0·2524	0·2524	—	—
Step 6. Observed altitude: $H_O = H - R + PA \pm S$	21·4827	2·7779	34·3924	26·5893	4·2938	49·5258

Note that for the Moon the correction for the oblateness of the Earth of about $-0°{\cdot}0017\cos H$, which equals $-0°{\cdot}0014$ for the lower limb and $-0°{\cdot}0015$ for the upper limb, has been ignored in the above calculation.

10. *Position from intercept and azimuth using a chart.* An estimate is made of the position at the adopted time of fix. The position at the time of observation is then calculated by dead reckoning from the time of fix. For example if the course (track) T and the speed V (in knots) of the observer are constant then *Long* and *Lat* at the time of observation are calculated from

$$Long = L_F + t\,(V/60)\sin T / \cos B_F$$
$$Lat = B_F + t\,(V/60)\cos T$$

where L_F and B_F are the estimated longitude and latitude at the time of fix and t is the time interval in hours from the time of fix to the time of observation, t is positive if the time of observation is after the time of fix and negative if it was before.

The position line of an observation is plotted on a chart using the intercept

$$p = H_O - H_C$$

and azimuth Z with origin at the calculated position (*Long*, *Lat*) at the time of observation, where H_C and Z are calculated using the method in section 6, page 279. Starting from this calculated position a line is drawn on the chart along the direction of the azimuth to the body. Convert p to nautical miles by multiplying by 60. The position line is drawn at right angles to the azimuth line, distance p from (*Long*, *Lat*) towards the body if p is positive and distance p away from the body if p is negative. Provided there are no gross errors the navigator should be somewhere on or near the position line at the time of observation. Two or more position lines are required to determine a fix.

11. *Position from intercept and azimuth by calculation.* The position of the fix may be calculated from two or more sextant observations as follows.

If p_1, Z_1, are the intercept and azimuth of the first observation, p_2, Z_2, of the second observation and so on, form the summations

$$A = \cos^2 Z_1 + \cos^2 Z_2 + \cdots$$
$$B = \cos Z_1 \sin Z_1 + \cos Z_2 \sin Z_2 + \cdots$$
$$C = \sin^2 Z_1 + \sin^2 Z_2 + \cdots$$
$$D = p_1 \cos Z_1 + p_2 \cos Z_2 + \cdots$$
$$E = p_1 \sin Z_1 + p_2 \sin Z_2 + \cdots$$

where the number of terms in each summation is equal to the number of observations.

With $G = A\,C - B^2$, an improved estimate of the position at the time of fix (L_I, B_I) is given by

$$L_I = L_F + (A\,E - B\,D)/(G\cos B_F), \qquad B_I = B_F + (C\,D - B\,E)/G$$

Calculate the distance d between the initial estimated position (L_F, B_F) at the time of fix and the improved estimated position (L_I, B_I) in nautical miles from

$$d = 60\sqrt{((L_I - L_F)^2 \cos^2 B_F + (B_I - B_F)^2)}$$

If d exceeds about 20 nautical miles set $L_F = L_I$, $B_F = B_I$ and repeat the calculation until d, the distance between the position at the previous estimate and the improved estimate, is less than about 20 nautical miles.

12. *Example of direct computation.* Using the method described above, calculate the position of a ship on 2011 June 28 at $21^h\ 00^m\ 00^s$ UT from the marine sextant observations of the three stars *Regulus* (No. 26) at $20^h\ 39^m\ 23^s$ UT, *Antares* (No. 42) at $20^h\ 45^m\ 47^s$ UT and *Kochab* (No. 40) at $21^h\ 10^m\ 34^s$ UT, where the observed altitudes of the three stars corrected for the effects of refraction, dip and instrumental error, are 32°2638, 23°3174 and 47°5001 respectively. The ship was travelling at a constant speed of 20 knots on a course of 325° during the period of observation, and the position of the ship at the time of fix $21^h\ 00^m\ 00^s$ UT is only known to the nearest whole degree W 15°, N 32°.

Intermediate values for the first iteration are shown in the table. *GHA* Aries was interpolated from the nearest tabular values on page 128. For the first iteration set $L_F = -15°0000$, $B_F = +32°0000$ at the time of fix at $21^h\ 00^m\ 00^s$ UT.

	First Iteration		
Body	*Regulus*	*Antares*	*Kochab*
No.	26	42	40
time of observation	$20^h\ 39^m\ 23^s$	$20^h\ 45^m\ 47^s$	$21^h\ 10^m\ 34^s$
H_O	32·2638	23·3174	47·5001
interpolation factor	0·6564	0·7631	0·1761
GHA Aries	226·4432	228·0476	234·2604
SHA (page 128)	207·7533	112·4600	137·3183
GHA	74·1965	340·5076	11·5787
Dec (page 128)	+11·9100	−26·4583	+74·1117
t	−0·3436	−0·2369	+0·1761
Long	−14·9225	−14·9466	−15·0397
Lat	+31·9062	+31·9353	+32·0481
Z	263·9575	146·6286	1·4126
H_C	32·2407	23·0116	47·9002
p	+0·0231	+0·3058	−0·4001

$$A = 1{\cdot}7079 \quad B = -0{\cdot}3300 \quad C = 1{\cdot}2921 \quad D = -0{\cdot}6578 \quad E = 0{\cdot}1354 \quad G = 2{\cdot}0978$$
$$(A\,E - B\,D)/(G\cos B_F) = +0{\cdot}0079, \qquad (C\,D - B\,E)/G = -0{\cdot}3838$$

An improved estimate of the position at the time of fix is

$$L_I = L_F + 0{\cdot}0079 = -14{\cdot}9921 \quad \text{and} \quad B_I = B_F - 0{\cdot}3838 = +31{\cdot}6162$$

Since the distance between the previous estimated position and the improved estimate $d = 23{\cdot}0$ nautical miles set $L_F = -14{\cdot}9921$, and $B_F = +31{\cdot}6162$ and repeat the calculation. The table shows the intermediate values of the calculation for the second iteration. In each iteration the quantities H_O, *GHA*, *Dec* and *t* do not change.

	Second Iteration		
Body	*Regulus*	*Antares*	*Kochab*
No.	26	42	40
Long	−14·9149	−14·9389	−15·0316
Lat	+31·5223	+31·5515	+31·6642
Z	264·2029	146·5445	1·3989
H_C	32·2738	23·3356	47·5167
p	−0·0101	−0·0182	−0·0165

$$A = 1{\cdot}7057 \quad B = -0{\cdot}3351 \quad C = 1{\cdot}2943 \quad D = -0{\cdot}0003 \quad E = -0{\cdot}0004 \quad G = 2{\cdot}0954$$
$$(A\,E - B\,D)/(G\cos B_F) = -0{\cdot}0005, \qquad (C\,D - B\,E)/G = -0{\cdot}0003$$

An improved estimate of the position at the time of fix is

$$L_I = L_F - 0{\cdot}0005 = -14{\cdot}9926 \quad \text{and} \quad B_I = B_F - 0{\cdot}0003 = +31{\cdot}6159$$

The distance between the previous estimated position and the improved estimated position $d = 0{\cdot}03$ nautical miles is so small that a third iteration would produce a negligible improvement to the estimate of the position.

USE OF CONCISE SIGHT REDUCTION TABLES

1. *Introduction.* The concise sight reduction tables given on pages 286 to 317 are intended for use when neither more extensive tables nor electronic computing aids are available. These "NAO sight reduction tables" provide for the reduction of the local hour angle and declination of a celestial object to azimuth and altitude, referred to an assumed position on the Earth, for use in the intercept method of celestial navigation which is now standard practice.

2. *Form of tables.* Entries in the reduction table are at a fixed interval of one degree for all latitudes and hour angles. A compact arrangement results from division of the navigational triangle into two right spherical triangles, so that the table has to be entered twice. Assumed latitude and local hour angle are the arguments for the first entry. The reduction table responds with the intermediate arguments A, B, and Z_1, where A is used as one of the arguments for the second entry to the table, B has to be incremented by the declination to produce the quantity F, and Z_1 is a component of the azimuth angle. The reduction table is then reentered with A and F and yields H, P, and Z_2 where H is the altitude, P is the complement of the parallactic angle, and Z_2 is the second component of the azimuth angle. It is usually necessary to adjust the tabular altitude for the fractional parts of the intermediate entering arguments to derive computed altitude, and an auxiliary table is provided for the purpose. Rules governing signs of the quantities which must be added or subtracted are given in the instructions and summarized on each tabular page. Azimuth angle is the sum of two components and is converted to true azimuth by familiar rules, repeated at the bottom of the tabular pages.

Tabular altitude and intermediate quantities are given to the nearest minute of arc, although errors of 2′ in computed altitude may accrue during adjustment for the minutes parts of entering arguments. Components of azimuth angle are stated to 0°.1; for derived true azimuth, only whole degrees are warranted. Since objects near the zenith are difficult to observe with a marine sextant, they should be avoided; altitudes greater than about 80° are not suited to reduction by this method.

In many circumstances the accuracy provided by these tables is sufficient. However, to maintain the full accuracy (0′.1) of the ephemeral data in the almanac throughout their reduction to altitude and azimuth, more extensive tables or a calculator should be used.

3. *Use of Tables.*

Step 1. Determine the Greenwich hour angle (*GHA*) and Declination (*Dec*) of the body from the almanac. Select an assumed latitude (*Lat*) of integral degrees nearest to the estimated latitude. Choose an assumed longitude nearest to the estimated longitude such that the local hour angle

$$LHA = GHA \begin{matrix} - \text{ west} \\ + \text{ east} \end{matrix} \text{ longitude}$$

has integral degrees.

Step 2. Enter the reduction table with *Lat* and *LHA* as arguments. Record the quantities A, B and Z_1. Apply the rules for the sign of B and Z_1: B is minus if $90° < LHA < 270°$: Z_1 has the same sign as B. Set $A°$ = nearest whole degree of A and A' = minutes part of A. This step may be repeated for all reductions before leaving the latitude opening of the table.

Step 3. Record the declination *Dec*. Apply the rules for the sign of *Dec*: *Dec* is minus if the name of *Dec* (*i.e.* N or S) is contrary to latitude. Add B and *Dec* algebraically to produce F. If F is negative, the object is below the horizon (in sight reduction, this can occur when the objects are close to the horizon). Regard F as positive until step 7. Set $F°$ = nearest whole degree of F and F' = minutes part of F.

Step 4. Enter the reduction table a second time with $A°$ and $F°$ as arguments and record H, P, and Z_2. Set $P° =$ nearest whole degree of P and $Z_2° =$ nearest whole degree of Z_2.

Step 5. Enter the auxiliary table with F' and $P°$ as arguments to obtain $corr_1$ to H for F'. Apply the rule for the sign of $corr_1$: $corr_1$ is minus if $F < 90°$ and $F' > 29'$ or if $F > 90°$ and $F' < 30'$, otherwise $corr_1$ is plus.

Step 6. Enter the auxiliary table with A' and $Z_2°$ as arguments to obtain $corr_2$ to H for A'. Apply the rule for the sign of $corr_2$: $corr_2$ is minus if $A' < 30'$, otherwise $corr_2$ is plus.

Step 7. Calculate the computed altitude H_C as the sum of H, $corr_1$ and $corr_2$. Apply the rule for the sign of H_C: H_C is minus if F is negative.

Step 8. Apply the rule for the sign of Z_2: Z_2 is minus if $F > 90°$. If F is negative, replace Z_2 by $180° - Z_2$. Set the azimuth angle Z equal to the algebraic sum of Z_1 and Z_2 and ignore the resulting sign. Obtain the true azimuth Z_n from the rules

For N latitude, if	$LHA > 180°$	$Z_n = Z$
if	$LHA < 180°$	$Z_n = 360° - Z$
For S latitude, if	$LHA > 180°$	$Z_n = 180° - Z$
if	$LHA < 180°$	$Z_n = 180° + Z$

Observed altitude H_O is compared with H_C to obtain the altitude difference, which, with Z_n, is used to plot the position line.

4. *Example.* (a) Required the altitude and azimuth of *Schedar* on 2011 February 5 at UT $06^h\ 30^m$ from the estimated position 5° east, 53° north.

1. Assumed latitude	$Lat =$	53° N		
From the almanac	$GHA =$	222° 17′		
Assumed longitude		4° 43′ E		
Local hour angle	$LHA =$	227		
2. Reduction table, 1st entry				
$(Lat, LHA) = (53, 227)$	$A =$	26 07	$A° = 26, A' = 7$	
	$B =$	−27 12	$Z_1 = -49{\cdot}4,$	$90° < LHA < 270°$
3. From the almanac	$Dec =$	+56 36		*Lat* and *Dec* same
Sum $= B + Dec$	$F =$	+29 24	$F° = 29, F' = 24$	
4. Reduction table, 2nd entry				
$(A°, F°) = (26, 29)$	$H =$	25 50	$P° = 61$	
			$Z_2 = 76{\cdot}3, Z_2° = 76$	
5. Auxiliary table, 1st entry				
$(F', P°) = (24, 61)$	$corr_1 =$	+21		$F < 90°, F' < 29'$
Sum		26 11		
6. Auxiliary table, 2nd entry				
$(A', Z_2°) = (7, 76)$	$corr_2 =$	−2		$A' < 30'$
7. Sum = computed altitude	$H_C =$	+26° 09′		$F > 0°$
8. Azimuth, first component	$Z_1 =$	−49·4		same sign as B
second component	$Z_2 =$	+76·3		$F < 90°, F > 0°$
Sum = azimuth angle	$Z =$	26·9		
True azimuth	$Z_n =$	027°		N *Lat*, $LHA > 180°$

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SIGHT REDUCTION TABLE

B: (−) for 90° < LHA < 270°
Dec:(−) for Lat. contrary name

Z_1: same sign as B
Z_2: (−) for F > 90°

Lat. / A	0°			1°			2°			3°			4°			5°			Lat. / A
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° °
0 180	0 00	90 00	90·0	0 00	89 00	90·0	0 00	88 00	90·0	0 00	87 00	90·0	0 00	86 00	90·0	0 00	85 00	90·0	180 360
1 179	1 00	90 00	90·0	1 00	89 00	90·0	1 00	88 00	90·0	1 00	87 00	89·9	1 00	86 00	89·9	1 00	85 00	89·9	181 359
2 178	2 00	90 00	90·0	2 00	89 00	90·0	2 00	88 00	89·9	2 00	87 00	89·9	2 00	86 00	89·9	2 00	85 00	89·8	182 358
3 177	3 00	90 00	90·0	3 00	89 00	89·9	3 00	88 00	89·9	3 00	87 00	89·8	3 00	86 00	89·8	2 59	85 00	89·7	183 357
4 176	4 00	90 00	90·0	4 00	89 00	89·9	4 00	88 00	89·9	4 00	87 00	89·8	3 59	85 59	89·7	3 59	84 59	89·7	184 356
5 175	5 00	90 00	90·0	5 00	89 00	89·9	5 00	88 00	89·8	5 00	86 59	89·7	4 59	85 59	89·7	4 59	84 59	89·6	185 355
6 174	6 00	90 00	90·0	6 00	89 00	89·9	6 00	87 59	89·8	6 00	86 59	89·7	5 59	85 59	89·6	5 59	84 58	89·5	186 354
7 173	7 00	90 00	90·0	7 00	89 00	89·9	7 00	87 59	89·8	6 59	86 59	89·6	6 59	85 58	89·5	6 58	84 58	89·4	187 353
8 172	8 00	90 00	90·0	8 00	88 59	89·9	8 00	87 59	89·7	7 59	86 58	89·6	7 59	85 58	89·4	7 58	84 57	89·3	188 352
9 171	9 00	90 00	90·0	9 00	88 59	89·8	9 00	87 59	89·7	8 59	86 58	89·5	8 59	85 57	89·4	8 58	84 56	89·2	189 351
10 170	10 00	90 00	90·0	10 00	88 59	89·8	10 00	87 58	89·6	9 59	86 57	89·5	9 59	85 56	89·3	9 58	84 55	89·1	190 350
11 169	11 00	90 00	90·0	11 00	88 59	89·8	11 00	87 58	89·6	10 59	86 57	89·4	10 58	85 56	89·2	10 57	84 54	89·0	191 349
12 168	12 00	90 00	90·0	12 00	88 59	89·8	12 00	87 57	89·6	11 59	86 56	89·4	11 58	85 55	89·2	11 57	84 53	88·9	192 348
13 167	13 00	90 00	90·0	13 00	88 58	89·8	13 00	87 57	89·5	12 59	86 55	89·3	12 58	85 54	89·1	12 57	84 52	88·8	193 347
14 166	14 00	90 00	90·0	14 00	88 58	89·8	13 59	87 56	89·5	13 59	86 55	89·3	13 58	85 53	89·0	13 57	84 51	88·8	194 346
15 165	15 00	90 00	90·0	15 00	88 58	89·7	14 59	87 56	89·5	14 59	86 54	89·2	14 58	85 52	88·9	14 56	84 49	88·7	195 345
16 164	16 00	90 00	90·0	16 00	88 58	89·7	15 59	87 55	89·4	15 59	86 53	89·1	15 58	85 50	88·9	15 56	84 48	88·6	196 344
17 163	17 00	90 00	90·0	17 00	88 57	89·7	16 59	87 55	89·4	16 59	86 52	89·1	16 57	85 49	88·8	16 56	84 46	88·5	197 343
18 162	18 00	90 00	90·0	18 00	88 57	89·7	17 59	87 54	89·4	17 58	86 51	89·0	17 57	85 48	88·7	17 56	84 45	88·4	198 342
19 161	19 00	90 00	90·0	19 00	88 57	89·7	18 59	87 53	89·3	18 58	86 50	89·0	18 57	85 46	88·6	18 55	84 43	88·3	199 341
20 160	20 00	90 00	90·0	20 00	88 56	89·6	19 59	87 52	89·3	19 58	86 48	88·9	19 57	85 45	88·5	19 55	84 41	88·2	200 340
21 159	21 00	90 00	90·0	21 00	88 56	89·6	20 59	87 51	89·2	20 58	86 47	88·8	20 57	85 43	88·5	20 55	84 39	88·1	201 339
22 158	22 00	90 00	90·0	22 00	88 55	89·6	21 59	87 51	89·2	21 58	86 46	88·8	21 57	85 41	88·4	21 55	84 37	88·0	202 338
23 157	23 00	90 00	90·0	23 00	88 55	89·6	22 59	87 50	89·2	22 58	86 44	88·7	22 56	85 39	88·3	22 54	84 34	87·9	203 337
24 156	24 00	90 00	90·0	24 00	88 54	89·6	23 59	87 49	89·1	23 58	86 43	88·7	23 56	85 37	88·2	23 54	84 32	87·8	204 336
25 155	25 00	90 00	90·0	25 00	88 54	89·5	24 59	87 48	89·1	24 58	86 41	88·6	24 56	85 35	88·1	24 54	84 29	87·7	205 335
26 154	26 00	90 00	90·0	26 00	88 53	89·5	25 59	87 47	89·0	25 58	86 40	88·5	25 56	85 33	88·1	25 54	84 26	87·6	206 334
27 153	27 00	90 00	90·0	27 00	88 53	89·5	26 59	87 45	89·0	26 58	86 38	88·5	26 56	85 31	88·0	26 53	84 24	87·5	207 333
28 152	28 00	90 00	90·0	28 00	88 52	89·5	27 59	87 44	88·9	27 57	86 36	88·4	27 56	85 28	87·9	27 53	84 20	87·3	208 332
29 151	29 00	90 00	90·0	29 00	88 51	89·4	28 59	87 43	88·9	28 57	86 34	88·3	28 55	85 26	87·8	28 53	84 17	87·2	209 331
30 150	30 00	90 00	90·0	30 00	88 51	89·4	29 59	87 41	88·8	29 57	86 32	88·3	29 55	85 23	87·7	29 52	84 14	87·1	210 330
31 149	31 00	90 00	90·0	31 00	88 50	89·4	30 59	87 40	88·8	30 57	86 30	88·2	30 55	85 20	87·6	30 52	84 10	87·0	211 329
32 148	32 00	90 00	90·0	32 00	88 49	89·4	31 59	87 39	88·8	31 57	86 28	88·1	31 55	85 17	87·5	31 52	84 07	86·9	212 328
33 147	33 00	90 00	90·0	33 00	88 48	89·4	32 59	87 37	88·7	32 57	86 25	88·1	32 55	85 14	87·4	32 52	84 03	86·8	213 327
34 146	34 00	90 00	90·0	34 00	88 48	89·3	33 59	87 35	88·7	33 57	86 23	88·0	33 54	85 11	87·3	33 51	83 59	86·6	214 326
35 145	35 00	90 00	90·0	35 00	88 47	89·3	34 59	87 34	88·6	34 57	86 20	87·9	34 54	85 07	87·2	34 51	83 54	86·5	215 325
36 144	36 00	90 00	90·0	36 00	88 46	89·3	35 58	87 32	88·5	35 57	86 18	87·8	35 54	85 04	87·1	35 51	83 50	86·4	216 324
37 143	37 00	90 00	90·0	37 00	88 45	89·2	36 58	87 30	88·5	36 56	86 15	87·7	36 54	85 00	87·0	36 50	83 45	86·2	217 323
38 142	38 00	90 00	90·0	38 00	88 44	89·2	37 58	87 28	88·4	37 56	86 12	87·7	37 53	84 56	86·9	37 50	83 40	86·1	218 322
39 141	39 00	90 00	90·0	39 00	88 43	89·2	38 58	87 26	88·4	38 56	86 09	87·6	38 53	84 52	86·8	38 49	83 35	86·0	219 321
40 140	40 00	90 00	90·0	40 00	88 42	89·2	39 58	87 23	88·3	39 56	86 05	87·5	39 53	84 47	86·7	39 49	83 29	85·8	220 320
41 139	41 00	90 00	90·0	41 00	88 41	89·1	40 58	87 21	88·3	40 56	86 02	87·4	40 53	84 42	86·5	40 49	83 23	85·7	221 319
42 138	42 00	90 00	90·0	42 00	88 39	89·1	41 58	87 19	88·2	41 56	85 58	87·3	41 52	84 37	86·4	41 48	83 17	85·5	222 318
43 137	43 00	90 00	90·0	43 00	88 38	89·1	42 58	87 16	88·1	42 56	85 54	87·2	42 52	84 32	86·3	42 48	83 11	85·4	223 317
44 136	44 00	90 00	90·0	43 59	88 37	89·0	43 58	87 13	88·1	43 55	85 50	87·1	43 52	84 27	86·1	43 47	83 04	85·2	224 316
45 135	45 00	90 00	90·0	44 59	88 35	89·0	44 58	87 10	88·0	44 55	85 46	87·0	44 52	84 21	86·0	44 47	82 57	85·0	225 315

Lat. / A	0°			1°			2°			3°			4°			5°			Lat. / A
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° °
45 135	45 00	90 00	90·0	44 59	88 35	89·0	44 58	87 10	88·0	44 55	85 46	87·0	44 52	84 21	86·0	44 47	82 57	85·0	225 315
46 134	46 00	90 00	90·0	45 59	88 34	89·0	45 58	87 07	87·9	45 55	85 41	86·9	45 51	84 15	85·9	45 46	82 49	84·8	226 314
47 133	47 00	90 00	90·0	46 59	88 32	88·9	46 58	87 04	87·9	46 55	85 36	86·8	46 51	84 09	85·7	46 46	82 41	84·7	227 313
48 132	48 00	90 00	90·0	47 59	88 30	88·9	47 58	87 01	87·8	47 55	85 31	86·7	47 51	84 02	85·6	47 46	82 33	84·5	228 312
49 131	49 00	90 00	90·0	48 59	88 29	88·8	48 58	86 57	87·7	48 55	85 26	86·6	48 50	83 55	85·4	48 45	82 24	84·3	229 311
50 130	50 00	90 00	90·0	49 59	88 27	88·8	49 58	86 53	87·6	49 54	85 20	86·4	49 50	83 47	85·2	49 44	82 15	84·1	230 310
51 129	51 00	90 00	90·0	50 59	88 25	88·8	50 57	86 49	87·5	50 54	85 14	86·3	50 50	83 40	85·1	50 44	82 05	83·9	231 309
52 128	52 00	90 00	90·0	51 59	88 23	88·7	51 57	86 45	87·4	51 54	85 08	86·2	51 49	83 31	84·9	51 43	81 55	83·6	232 308
53 127	53 00	90 00	90·0	52 59	88 20	88·7	52 57	86 41	87·3	52 54	85 01	86·0	52 49	83 22	84·7	52 43	81 44	83·4	233 307
54 126	54 00	90 00	90·0	53 59	88 18	88·6	53 57	86 36	87·2	53 54	84 54	85·9	53 49	83 13	84·5	53 42	81 32	83·2	234 306
55 125	55 00	90 00	90·0	54 59	88 15	88·6	54 57	86 31	87·1	54 53	84 47	85·7	54 48	83 03	84·3	54 41	81 20	82·9	235 305
56 124	56 00	90 00	90·0	55 59	88 13	88·5	55 57	86 26	87·0	55 53	84 39	85·6	55 48	82 52	84·1	55 41	81 06	82·6	236 304
57 123	57 00	90 00	90·0	56 59	88 10	88·5	56 57	86 20	86·9	56 53	84 30	85·4	56 47	82 41	83·9	56 40	80 52	82·4	237 303
58 122	58 00	90 00	90·0	57 59	88 07	88·4	57 57	86 14	86·8	57 52	84 21	85·2	57 47	82 29	83·6	57 39	80 38	82·1	238 302
59 121	59 00	90 00	90·0	58 59	88 04	88·3	58 57	86 07	86·7	58 52	84 11	85·0	58 46	82 16	83·4	58 38	80 22	81·7	239 301
60 120	60 00	90 00	90·0	59 59	88 00	88·3	59 56	86 00	86·5	59 52	84 01	84·8	59 46	82 02	83·1	59 37	80 05	81·4	240 300
61 119	61 00	90 00	90·0	60 59	87 56	88·2	60 56	85 53	86·4	60 52	83 50	84·6	60 45	81 48	82·8	60 37	79 46	81·1	241 299
62 118	62 00	90 00	90·0	61 59	87 52	88·1	61 56	85 45	86·2	61 51	83 38	84·4	61 44	81 32	82·5	61 36	79 27	80·7	242 298
63 117	63 00	90 00	90·0	62 59	87 48	88·0	62 56	85 36	86·1	62 51	83 25	84·1	62 44	81 15	82·2	62 35	79 06	80·3	243 297
64 116	64 00	90 00	90·0	63 59	87 43	88·0	63 56	85 27	85·9	63 50	83 11	83·9	63 43	80 56	81·9	63 33	78 43	79·9	244 296
65 115	65 00	90 00	90·0	64 59	87 38	87·9	64 56	85 17	85·7	64 50	82 56	83·6	64 42	80 36	81·5	64 32	78 18	79·4	245 295
66 114	66 00	90 00	90·0	65 59	87 33	87·8	65 55	85 06	85·5	65 49	82 39	83·3	65 41	80 15	81·1	65 31	77 52	78·9	246 294
67 113	67 00	90 00	90·0	66 59	87 27	87·6	66 55	84 54	85·3	66 49	82 22	83·0	66 40	79 51	80·7	66 29	77 23	78·4	247 293
68 112	68 00	90 00	90·0	67 59	87 20	87·5	67 55	84 40	85·1	67 48	82 02	82·6	67 39	79 26	80·2	67 28	76 51	77·8	248 292
69 111	69 00	90 00	90·0	68 59	87 13	87·4	68 55	84 26	84·8	68 48	81 41	82·2	68 38	78 58	79·7	68 26	76 17	77·2	249 291
70 110	70 00	90 00	90·0	69 59	87 05	87·3	69 54	84 10	84·5	69 47	81 17	81·8	69 37	78 27	79·2	69 25	75 39	76·5	250 290
71 109	71 00	90 00	90·0	70 58	86 56	87·1	70 54	83 53	84·2	70 46	80 51	81·4	70 36	77 53	78·5	70 23	74 58	75·8	251 289
72 108	72 00	90 00	90·0	71 58	86 46	86·9	71 54	83 33	83·9	71 46	80 22	80·8	71 35	77 15	77·9	71 20	74 12	75·0	252 288
73 107	73 00	90 00	90·0	72 58	86 35	86·7	72 53	83 11	83·5	72 45	79 50	80·3	72 33	76 33	77·1	72 18	73 20	74·1	253 287
74 106	74 00	90 00	90·0	73 58	86 23	86·5	73 53	82 47	83·1	73 44	79 14	79·7	73 31	75 46	76·3	73 15	72 23	73·1	254 286
75 105	75 00	90 00	90·0	74 58	86 09	86·3	74 52	82 19	82·6	74 43	78 33	78·9	74 29	74 53	75·4	74 12	71 19	72·0	255 285
76 104	76 00	90 00	90·0	75 58	85 52	86·0	75 52	81 47	82·0	75 41	77 47	78·1	75 27	73 53	74·4	75 09	70 07	70·7	256 284
77 103	77 00	90 00	90·0	76 58	85 34	85·7	76 51	81 11	81·4	76 40	76 53	77·2	76 25	72 44	73·2	76 05	68 45	69·3	257 283
78 102	78 00	90 00	90·0	77 58	85 12	85·3	77 50	80 28	80·7	77 38	75 51	76·2	77 22	71 25	71·8	77 01	67 11	67·7	258 282
79 101	79 00	90 00	90·0	78 57	84 46	84·9	78 49	79 38	79·8	78 36	74 39	74·9	78 18	69 52	70·3	77 56	65 22	65·8	259 281
80 100	80 00	90 00	90·0	79 57	84 16	84·3	79 48	78 38	78·8	79 34	73 12	73·5	79 14	68 04	68·4	78 50	63 16	63·7	260 280
81 99	81 00	90 00	90·0	80 57	83 38	83·7	80 47	77 25	77·6	80 31	71 29	71·7	80 09	65 55	66·2	79 43	60 47	61·2	261 279
82 98	82 00	90 00	90·0	81 56	82 51	82·9	81 45	75 55	76·1	81 28	69 22	69·6	81 04	63 19	63·6	80 34	57 51	58·2	262 278
83 97	83 00	90 00	90·0	82 56	81 51	81·9	82 43	74 01	74·1	82 23	66 44	66·9	81 57	60 09	60·4	81 24	54 20	54·6	263 277
84 96	84 00	90 00	90·0	83 55	80 31	80·6	83 41	71 32	71·6	83 18	63 22	63·5	82 48	56 13	56·4	82 12	50 04	50·3	264 276
85 95	85 00	90 00	90·0	84 54	78 40	78·7	84 37	68 10	68·3	84 10	58 59	59·1	83 36	51 16	51·4	82 56	44 53	45·1	265 275
86 94	86 00	90 00	90·0	85 53	75 57	76·0	85 32	63 24	63·5	85 00	53 05	53·2	84 21	44 56	45·1	83 36	38 34	38 7	266 274
87 93	87 00	90 00	90·0	86 50	71 33	71·6	86 24	56 17	56·3	85 45	44 58	45·0	85 00	36 49	36·9	84 10	30 53	31·0	267 273
88 92	88 00	90 00	90·0	87 46	63 26	63·4	87 10	44 59	45·0	86 24	33 40	33·7	85 32	26 31	26·6	84 37	21 45	21·8	268 272
89 91	89 00	90 00	90·0	88 35	45 00	45·0	87 46	26 33	26·6	86 50	18 25	18·4	85 53	14 01	14·0	84 54	11 17	11·3	269 271
90 90	90 00	0 00	0·0	89 00	0 00	0·0	88 00	0 00	0·0	87 00	0 00	0·0	86 00	0 00	0·0	85 00	0 00	0·0	270 270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (−) for 90° < LHA < 270°
Dec:(−) for Lat. contrary name

Z_1: same sign as B
Z_2: (−) for F > 90°

Lat. / A	6°			7°			8°			9°			10°			11°			Lat. / A	
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
0 180	0 00	84 00	90·0	0 00	83 00	90·0	0 00	82 00	90·0	0 00	81 00	90·0	0 00	80 00	90·0	0 00	79 00	90·0	180	360
1 179	1 00	84 00	89·9	1 00	83 00	89·9	0 59	82 00	89·9	0 59	81 00	89·8	0 59	80 00	89·8	0 59	79 00	89·8	181	359
2 178	1 59	84 00	89·8	1 59	83 00	89·8	1 59	82 00	89·7	1 59	81 00	89·7	1 58	80 00	89·7	1 58	79 00	89·6	182	358
3 177	2 59	84 00	89·7	2 59	82 59	89·6	2 58	81 59	89·6	2 58	80 59	89·5	2 57	79 59	89·5	2 57	78 59	89·4	183	357
4 176	3 59	83 59	89·6	3 58	82 59	89·5	3 58	81 59	89·4	3 57	80 59	89·4	3 56	79 59	89·3	3 56	78 58	89·2	184	356
5 175	4 58	83 59	89·5	4 58	82 58	89·4	4 57	81 58	89·3	4 56	80 58	89·2	4 55	79 58	89·1	4 54	78 58	89·0	185	355
6 174	5 58	83 58	89·4	5 57	82 58	89·3	5 56	81 57	89·2	5 56	80 57	89·1	5 55	79 57	89·0	5 53	78 56	88·9	186	354
7 173	6 58	83 57	89·3	6 57	82 57	89·1	6 56	81 56	89·0	6 55	80 56	88·9	6 54	79 56	88·8	6 52	78 55	88·7	187	353
8 172	7 57	83 56	89·2	7 56	82 56	89·0	7 55	81 55	88·9	7 54	80 55	88·7	7 53	79 54	88·6	7 51	78 54	88·5	188	352
9 171	8 57	83 56	89·1	8 56	82 55	88·9	8 55	81 54	88·7	8 53	80 53	88·6	8 52	79 53	88·4	8 50	78 52	88·3	189	351
10 170	9 57	83 54	88·9	9 55	82 54	88·8	9 54	81 53	88·6	9 53	80 52	88·4	9 51	79 51	88·2	9 49	78 50	88·1	190	350
11 169	10 56	83 53	88·8	10 55	82 52	88·6	10 53	81 51	88·5	10 52	80 50	88·3	10 50	79 49	88·1	10 48	78 48	87·9	191	349
12 168	11 56	83 52	88·7	11 55	82 51	88·5	11 53	81 49	88·3	11 51	80 48	88·1	11 49	79 47	87·9	11 47	78 46	87·7	192	348
13 167	12 56	83 51	88·6	12 54	82 49	88·4	12 52	81 48	88·2	12 50	80 46	87·9	12 48	79 45	87·7	12 45	78 43	87·5	193	347
14 166	13 55	83 49	88·5	13 54	82 47	88·3	13 52	81 46	88·0	13 49	80 44	87·8	13 47	79 42	87·5	13 44	78 40	87·3	194	346
15 165	14 55	83 47	88·4	14 53	82 45	88·1	14 51	81 43	87·9	14 49	80 41	87·6	14 46	79 39	87·3	14 43	78 37	87·1	195	345
16 164	15 55	83 46	88·3	15 53	82 43	88·0	15 50	81 41	87·7	15 48	80 39	87·4	15 45	79 36	87·1	15 42	78 34	86·9	196	344
17 163	16 54	83 44	88·2	16 52	82 41	87·9	16 50	81 38	87·6	16 47	80 36	87·3	16 44	79 33	87·0	16 41	78 31	86·7	197	343
18 162	17 54	83 42	88·1	17 52	82 39	87·7	17 49	81 36	87·4	17 46	80 33	87·1	17 43	79 30	86·8	17 39	78 27	86·5	198	342
19 161	18 54	83 39	87·9	18 51	82 36	87·6	18 48	81 33	87·3	18 45	80 29	86·9	18 42	79 26	86·6	18 38	78 23	86·2	199	341
20 160	19 53	83 37	87·8	19 51	82 33	87·5	19 48	81 30	87·1	19 45	80 26	86·7	19 41	79 22	86·4	19 37	78 19	86·0	200	340
21 159	20 53	83 35	87·7	20 50	82 30	87·3	20 47	81 26	86·9	20 44	80 22	86·6	20 40	79 18	86·2	20 36	78 14	85·8	201	339
22 158	21 52	83 32	87·6	21 50	82 27	87·2	21 46	81 23	86·8	21 43	80 18	86·4	21 39	79 14	86·0	21 35	78 10	85·6	202	338
23 157	22 52	83 29	87·5	22 49	82 24	87·0	22 46	81 19	86·6	22 42	80 14	86·2	22 38	79 09	85·8	22 33	78 05	85·4	203	337
24 156	23 52	83 26	87·3	23 49	82 21	86·9	23 45	81 15	86·5	23 41	80 10	86·0	23 37	79 05	85·6	23 32	77 59	85·1	204	336
25 155	24 51	83 23	87·2	24 48	82 17	86·7	24 44	81 11	86·3	24 40	80 05	85·8	24 36	78 59	85·4	24 31	77 54	84·9	205	335
26 154	25 51	83 20	87·1	25 48	82 13	86·6	25 44	81 07	86·1	25 39	80 00	85·6	25 35	78 54	85·2	25 29	77 48	84·7	206	334
27 153	26 50	83 16	87·0	26 47	82 09	86·4	26 43	81 02	85·9	26 38	79 55	85·4	26 33	78 48	84·9	26 28	77 42	84·4	207	333
28 152	27 50	83 13	86·8	27 46	82 05	86·3	27 42	80 57	85·8	27 38	79 50	85·2	27 32	78 42	84·7	27 27	77 35	84·2	208	332
29 151	28 50	83 09	86·7	28 46	82 01	86·1	28 41	80 52	85·6	28 37	79 44	85·0	28 31	78 36	84·5	28 25	77 28	84·0	209	331
30 150	29 49	83 05	86·5	29 45	81 56	86·0	29 41	80 47	85·4	29 36	79 38	84·8	29 30	78 29	84·3	29 24	77 21	83·7	210	330
31 149	30 49	83 01	86·4	30 45	81 51	85·8	30 40	80 41	85·2	30 35	79 32	84·6	30 29	78 23	84·0	30 22	77 13	83·5	211	329
32 148	31 48	82 56	86·3	31 44	81 46	85·6	31 39	80 35	85·0	31 34	79 25	84·4	31 27	78 15	83·8	31 21	77 05	83·2	212	328
33 147	32 48	82 51	86·1	32 43	81 40	85·5	32 38	80 29	84·8	32 33	79 18	84·2	32 26	78 08	83·6	32 19	76 57	82·9	213	327
34 146	33 47	82 46	86·0	33 43	81 35	85·3	33 37	80 23	84·6	33 32	79 11	84·0	33 25	78 00	83·3	33 18	76 48	82·7	214	326
35 145	34 47	82 41	85·8	34 42	81 29	85·1	34 37	80 16	84·4	34 30	79 03	83·7	34 24	77 51	83·1	34 16	76 39	82·4	215	325
36 144	35 46	82 36	85·7	35 41	81 22	84·9	35 36	80 09	84·2	35 29	78 55	83·5	35 22	77 42	82·8	35 14	76 29	82·1	216	324
37 143	36 46	82 30	85·5	36 41	81 16	84·8	36 35	80 01	84·0	36 28	78 47.	83·3	36 21	77 33	82·5	36 13	76 19	81·8	217	323
38 142	37 45	82 24	85·3	37 40	81 09	84·6	37 34	79 53	83·8	37 27	78 38	83·0	37 19	77 23	82·3	37 11	76 09	81·5	218	322
39 141	38 45	82 18	85·2	38 39	81 01	84·4	38 33	79 45	83·6	38 26	78 29	82·8	38 18	77 13	82·0	38 09	75 57	81·2	219	321
40 140	39 44	82 11	85·0	39 39	80 54	84·2	39 32	79 36	83·3	39 25	78 19	82·5	39 16	77 02	81·7	39 07	75 46	80·9	220	320
41 139	40 44	82 04	84·8	40 38	80 46	84·0	40 31	79 27	83·1	40 23	78 09	82·3	40 15	76 51	81·4	40 05	75 33	80·6	221	319
42 138	41 43	81 57	84·6	41 37	80 37	83·7	41 30	79 17	82·9	41 22	77 58	82·0	41 13	76 39	81·1	41 04	75 21	80·3	222	318
43 137	42 42	81 49	84·4	42 36	80 28	83·5	42 29	79 07	82·6	42 21	77 47	81·7	42 12	76 27	80·8	42 02	75 07	79·9	223	317
44 136	43 42	81 41	84·2	43 35	80 19	83·3	43 28	78 57	82·3	43 19	77 35	81·4	43 10	76 14	80·5	43 00	74 53	79·6	224	316
45 135	44 41	81 33	84·0	44 34	80 09	83·1	44 27	78 46	82·1	44 18	77 22	81·1	44 08	76 00	80·1	43 57	74 38	79·2	225	315

Lat. / A		6°			7°			8°			9°			10°			11°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	44 41	81 33	84·0	44 34	80 09	83·1	44 27	78 46	82·1	44 18	77 22	81·1	44 08	76 00	80·1	43 57	74 38	79·2	225	315
46	134	45 41	81 24	83·8	45 34	79 59	82·8	45 26	78 34	81·8	45 16	77 09	80·8	45 06	75 45	79·8	44 55	74 22	78·8	226	314
47	133	46 40	81 14	83·6	46 33	79 48	82·6	46 24	78 21	81·5	46 15	76 56	80·5	46 04	75 30	79·5	45 53	74 05	78·4	227	313
48	132	47 39	81 04	83·4	47 32	79 36	82·3	47 23	78 08	81·2	47 13	76 41	80·1	47 03	75 14	79·1	46 51	73 48	78·0	228	312
49	131	48 38	80 54	83·1	48 31	79 24	82·0	48 22	77 55	80·9	48 12	76 26	79·8	48 01	74 57	78·7	47 48	73 30	77·6	229	311
50	130	49 38	80 43	82·9	49 30	79 11	81·7	49 20	77 40	80·6	49 10	76 09	79·4	48 58	74 40	78·3	48 46	73 10	77·2	230	310
51	129	50 37	80 31	82·6	50 29	78 58	81·4	50 19	77 25	80·2	50 08	75 52	79·1	49 56	74 21	77·9	49 43	72 50	76·7	231	309
52	128	51 36	80 19	82·4	51 27	78 43	81·1	51 18	77 08	79·9	51 06	75 34	78·7	50 54	74 01	77·5	50 40	72 29	76·3	232	308
53	127	52 35	80 06	82·1	52 26	78 28	80·8	52 16	76 51	79·5	52 04	75 15	78·3	51 52	73 40	77·0	51 37	72 06	75·8	233	307
54	126	53 34	79 52	81·8	53 25	78 12	80·5	53 14	76 33	79·2	53 02	74 55	77·8	52 49	73 18	76·6	52 35	71 42	75·3	234	306
55	125	54 33	79 37	81·5	54 24	77 55	80·1	54 13	76 14	78·8	54 00	74 34	77·4	53 47	72 55	76·1	53 31	71 17	74·8	235	305
56	124	55 32	79 21	81·2	55 22	77 37	79·8	55 11	75 54	78·3	54 58	74 11	76·9	54 44	72 30	75·6	54 28	70 50	74·2	236	304
57	123	56 31	79 05	80·9	56 21	77 18	79·4	56 09	75 32	77·9	55 56	73 47	76·5	55 41	72 04	75·0	55 25	70 22	73·6	237	303
58	122	57 30	78 47	80·5	57 19	76 57	79·0	57 07	75 09	77·4	56 53	73 22	75·9	56 38	71 36	74·5	56 21	69 51	73·0	238	302
59	121	58 29	78 28	80·1	58 18	76 35	78·5	58 05	74 44	77·0	57 51	72 54	75·4	57 35	71 06	73·9	57 17	69 19	72·4	239	301
60	120	59 28	78 08	79·7	59 16	76 12	78·1	59 03	74 18	76·4	58 48	72 25	74·8	58 32	70 34	73·3	58 13	68 45	71·7	240	300
61	119	60 26	77 46	79·3	60 14	75 47	77·6	60 01	73 50	75·9	59 45	71 54	74·2	59 28	70 01	72·6	59 09	68 09	71·0	241	299
62	118	61 25	77 23	78·9	61 12	75 21	77·1	60 58	73 20	75·3	60 42	71 21	73 6	60 24	69 25	71·9	60 05	67 31	70·3	242	298
63	117	62 23	76 58	78·4	62 10	74 52	76·5	61 56	72 48	74·7	61 39	70 46	72·9	61 20	68 46	71·2	61 00	66 49	69·5	243	297
64	116	63 22	76 31	77·9	63 08	74 21	76·0	62 53	72 13	74·1	62 35	70 08	72·2	62 16	68 05	70·4	61 55	66 05	68·6	244	296
65	115	64 20	76 02	77·4	64 06	73 48	75·4	63 50	71 36	73·4	63 32	69 27	71·5	63 12	67 21	69·6	62 50	65 18	67·7	245	295
66	114	65 18	75 31	76·8	65 03	73 12	74·7	64 47	70 56	72·6	64 28	68 43	70·6	64 07	66 34	68·7	63 44	64 27	66·8	246	294
67	113	66 16	74 57	76·2	66 01	72 33	74·0	65 43	70 13	71·8	65 23	67 56	69·8	65 02	65 43	67·8	64 38	63 33	65·8	247	293
68	112	67 14	74 20	75·5	66 58	71 51	73·2	66 40	69 26	71·0	66 19	67 05	68·8	65 56	64 48	66·7	65 32	62 35	64·7	248	292
69	111	68 12	73 39	74·8	67 55	71 05	72·4	67 36	68 35	70·1	67 14	66 09	67·8	66 50	63 48	65·7	66 25	61 31	63·6	249	291
70	110	69 09	72 55	74·0	68 51	70 15	71·5	68 31	67 40	69·1	68 09	65 09	66·7	67 44	62 44	64·5	67 17	60 23	62·3	250	290
71	109	70 07	72 06	73·1	69 48	69 20	70·5	69 27	66 39	68·0	69 03	64 03	65·6	68 37	61 34	63·2	68 09	59 10	61·0	251	289
72	108	71 03	71 13	72·2	70 44	68 20	69·4	70 21	65 33	66·8	69 57	62 52	64·3	69 29	60 17	61·9	69 00	57 50	59·6	252	288
73	107	72 00	70 14	71·1	71 39	67 13	68·3	71 16	64 20	65·5	70 50	61 33	62·9	70 21	58 54	60·4	69 50	56 23	58·0	253	287
74	106	72 56	69 08	70·0	72 34	65 59	67·0	72 09	62 59	64·1	71 42	60 07	61·4	71 12	57 24	58·8	70 40	54 49	56·4	254	286
75	105	73 52	67 54	68·7	73 29	64 37	65·5	73 03	61 30	62·6	72 34	58 32	59·7	72 02	55 44	57·1	71 28	53 06	54·5	255	285
76	104	74 48	66 31	67·3	74 23	63 05	64·0	73 55	59 51	60·8	73 24	56 47	57·9	72 51	53 55	55·1	72 16	51 13	52·6	256	284
77	103	75 42	64 57	65·6	75 16	61 22	62·2	74 46	58 00	58·9	74 14	54 51	55·9	73 39	51 55	53·1	73 02	49 10	50·4	257	283
78	102	76 36	63 11	63·8	76 08	59 26	60·2	75 37	55 57	56·8	75 02	52 42	53·6	74 26	49 42	50·8	73 47	46 56	48·1	258	282
79	101	77 29	61 09	61·7	76 59	57 14	57·9	76 26	53 38	54·4	75 49	50 18	51·2	75 11	47 16	48·2	74 30	44 28	45·5	259	281
80	100	78 21	58 49	59·3	77 49	54 44	55·3	77 13	51 01	51·7	76 35	47 38	48·4	75 54	44 34	45·4	75 11	41 47	42·7	260	280
81	99	79 12	56 06	56·6	78 37	51 52	52·4	77 59	48 04	48·7	77 18	44 39	45·4	76 35	41 35	42·4	75 49	38 50	39·7	261	279
82	98	80 01	52 56	53·4	79 23	48 35	49·1	78 42	44 43	45·3	77 59	41 18	41·9	77 13	38 17	39·0	76 26	35 36	36·4	262	278
83	97	80 47	49 13	49·6	80 07	44 47	45·2	79 23	40 56	41·4	78 37	37 35	38·1	77 49	34 39	35·3	76 59	32 05	32·8	263	277
84	96	81 31	44 51	45·2	80 47	40 24	40·8	80 01	36 38	37·1	79 12	33 25	33·9	78 21	30 40	31·2	77 29	28 16	28·8	264	276
85	95	82 12	39 40	39·9	81 24	35 22	35·7	80 34	31 48	32·2	79 43	28 49	29·2	78 50	26 18	26·7	77 56	24 09	24·6	265	275
86	94	82 48	33 34	33·8	81 57	29 36	29·8	81 04	26 24	26·7	80 09	23 46	24·1	79 14	21 35	21·9	78 18	19 44	20·1	266	274
87	93	83 18	26 28	26·6	82 23	23 05	23·3	81 28	20 25	20·6	80 31	18 17	18·5	79 34	16 32	16·8	78 36	15 04	15·4	267	273
88	92	83 41	18 22	18·5	82 43	15 52	16·0	81 45	13 57	14·1	80 47	12 26	12·6	79 48	11 12	11·4	78 49	10 11	10·4	268	272
89	91	83 55	9 26	9·5	82 56	8 05	8·2	81 56	7 05	7·1	80 57	6 17	6·4	79 57	5 39	5·7	78 57	5 08	5·2	269	271
90	90	84 00	0 00	0·0	83 00	0 00	0·0	82 00	0 00	0·0	81 00	0 00	0·0	80 00	0 00	0·0	79 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (–) for 90° < LHA < 270°
Dec:(–) for Lat. contrary name

Z_1: same sign as B
Z_2: (–) for F > 90°

Lat. / A	12°			13°			14°			15°			16°			17°			Lat. / A
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° °
0 180	0 00	78 00	90·0	0 00	77 00	90·0	0 00	76 00	90·0	0 00	75 00	90·0	0 00	74 00	90·0	0 00	73 00	90·0	180 360
1 179	0 59	78 00	89·8	0 58	77 00	89·8	0 58	76 00	89·8	0 58	75 00	89·7	0 58	74 00	89·7	0 57	73 00	89·7	181 359
2 178	1 57	78 00	89·6	1 57	77 00	89·5	1 56	76 00	89·5	1 56	74 59	89·5	1 55	73 59	89·4	1 55	72 59	89·4	182 358
3 177	2 56	77 59	89·4	2 55	76 59	89·3	2 55	75 59	89·3	2 54	74 59	89·2	2 53	73 59	89·2	2 52	72 59	89·1	183 357
4 176	3 55	77 58	89·2	3 54	76 58	89·1	3 53	75 58	89·0	3 52	74 58	89·0	3 51	73 58	88·9	3 49	72 58	88·8	184 356
5 175	4 53	77 57	89·0	4 52	76 57	88·9	4 51	75 57	88·8	4 50	74 57	88·7	4 48	73 57	88·6	4 47	72 56	88·5	185 355
6 174	5 52	77 56	88·7	5 51	76 56	88·6	5 49	75 56	88·5	5 48	74 55	88·4	5 46	73 55	88·3	5 44	72 55	88·2	186 354
7 173	6 51	77 55	88·5	6 49	76 54	88·4	6 47	75 54	88·3	6 46	74 54	88·2	6 44	73 53	88·1	6 42	72 53	87·9	187 353
8 172	7 49	77 53	88·3	7 48	76 53	88·2	7 46	75 52	88·1	7 44	74 52	87·9	7 41	73 51	87·8	7 39	72 51	87·6	188 352
9 171	8 48	77 51	88·1	8 46	76 51	88·0	8 44	75 50	87·8	8 41	74 49	87·7	8 39	73 49	87·5	8 36	72 48	87·3	189 351
10 170	9 47	77 49	87·9	9 44	76 48	87·7	9 42	75 48	87·6	9 39	74 47	87·4	9 37	73 46	87·2	9 34	72 45	87·0	190 350
11 169	10 45	77 47	87·7	10 43	76 46	87·5	10 40	75 45	87·3	10 37	74 44	87·1	10 34	73 43	86·9	10 31	72 42	86·7	191 349
12 168	11 44	77 44	87·5	11 41	76 43	87·3	11 38	75 42	87·1	11 35	74 41	86·9	11 32	73 40	86·6	11 28	72 39	86·4	192 348
13 167	12 43	77 42	87·3	12 40	76 40	87·0	12 36	75 39	86·8	12 33	74 37	86·6	12 29	73 36	86·4	12 25	72 35	86·1	193 347
14 166	13 41	77 39	87·0	13 38	76 37	86·8	13 35	75 35	86·5	13 31	74 34	86·3	13 27	73 32	86·1	13 23	72 31	85·8	194 346
15 165	14 40	77 35	86·8	14 36	76 33	86·6	14 33	75 32	86·3	14 29	74 30	86·0	14 24	73 28	85·8	14 20	72 26	85·5	195 345
16 164	15 38	77 32	86·6	15 35	76 30	86·3	15 31	75 28	86·0	15 26	74 25	85·8	15 22	73 23	85·5	15 17	72 21	85·2	196 344
17 163	16 37	77 28	86·4	16 33	76 26	86·1	16 29	75 23	85·8	16 24	74 21	85·5	16 19	73 19	85·2	16 14	72 16	84·9	197 343
18 162	17 36	77 24	86·1	17 31	76 21	85·8	17 27	75 19	85·5	17 22	74 16	85·2	17 17	73 13	84·9	17 11	72 11	84·6	198 342
19 161	18 34	77 20	85·9	18 30	76 17	85·6	18 25	75 14	85·2	18 20	74 11	84·9	18 14	73 08	84·6	18 08	72 05	84·3	199 341
20 160	19 33	77 15	85·7	19 28	76 12	85·3	19 23	75 08	85·0	19 17	74 05	84·6	19 12	73 02	84·3	19 05	71 59	83·9	200 340
21 159	20 31	77 10	85·4	20 26	76 07	85·1	20 21	75 03	84·7	20 15	73 59	84·3	20 09	72 56	84·0	20 03	71 52	83·6	201 339
22 158	21 30	77 05	85·2	21 24	76 01	84·8	21 19	74 57	84·4	21 13	73 53	84·0	21 06	72 49	83·6	21 00	71 45	83·3	202 338
23 157	22 28	77 00	85·0	22 23	75 55	84·5	22 17	74 51	84·1	22 10	73 46	83·7	22 04	72 42	83·3	21 56	71 38	82·9	203 337
24 156	23 27	76 54	84·7	23 21	75 49	84·3	23 15	74 44	83·9	23 08	73 39	83·4	23 01	72 34	83·0	22 53	71 30	82·6	204 336
25 155	24 25	76 48	84·5	24 19	75 43	84·0	24 13	74 37	83·6	24 06	73 32	83·1	23 58	72 27	82·7	23 50	71 22	82·2	205 335
26 154	25 23	76 42	84·2	25 17	75 36	83·7	25 10	74 30	83·3	25 03	73 24	82·8	24 55	72 18	82·3	24 47	71 13	81·9	206 334
27 153	26 22	76 35	84·0	26 15	75 28	83·5	26 08	74 22	83·0	26 01	73 16	82·5	25 52	72 10	82·0	25 44	71 04	81·5	207 333
28 152	27 20	76 28	83·7	27 13	75 21	83·2	27 06	74 14	82·7	26 58	73 07	82·2	26 50	72 00	81·7	26 41	70 54	81·2	208 332
29 151	28 18	76 20	83·4	28 11	75 13	82·9	28 04	74 05	82·4	27 55	72 58	81·8	27 47	71 51	81·3	27 37	70 44	80·8	209 331
30 150	29 17	76 13	83·2	29 09	75 04	82·6	29 01	73 56	82·0	28 53	72 48	81·5	28 44	71 41	81·0	28 34	70 33	80·4	210 330
31 149	30 15	76 04	82·9	30 07	74 56	82·3	29 59	73 47	81·7	29 50	72 38	81·2	29 41	71 30	80·6	29 30	70 22	80·0	211 329
32 148	31 13	75 56	82·6	31 05	74 46	82·0	30 57	73 37	81·4	30 47	72 28	80·8	30 37	71 19	80·2	30 27	70 11	79·6	212 328
33 147	32 11	75 47	82·3	32 03	74 37	81·7	31 54	73 27	81·1	31 44	72 17	80·5	31 34	71 07	79·9	31 23	69 58	79·2	213 327
34 146	33 10	75 37	82·0	33 01	74 26	81·4	32 52	73 16	80·7	32 42	72 05	80·1	32 31	70 55	79·5	32 20	69 45	78·8	214 326
35 145	34 08	75 27	81·7	33 59	74 16	81·0	33 49	73 04	80·4	33 39	71 53	79·7	33 28	70 42	79·1	33 16	69 32	78·4	215 325
36 144	35 06	75 17	81·4	34 56	74 04	80·7	34 46	72 52	80·0	34 36	71 40	79·4	34 24	70 29	78·7	34 12	69 18	78·0	216 324
37 143	36 04	75 06	81·1	35 54	73 53	80·4	35 44	72 40	79·7	35 33	71 27	79·0	35 21	70 15	78·3	35 08	69 03	77·6	217 323
38 142	37 02	74 54	80·8	36 52	73 40	80·0	36 41	72 27	79·3	36 29	71 13	78·6	36 17	70 00	77·8	36 04	68 48	77·1	218 322
39 141	38 00	74 42	80·4	37 49	73 27	79·7	37 38	72 13	78·9	37 26	70 59	78·2	37 13	69 45	77·4	37 00	68 32	76·7	219 321
40 140	38 57	74 30	80·1	38 47	73 14	79·3	38 35	71 58	78·5	38 23	70 43	77·7	38 10	69 29	77·0	37 56	68 15	76·2	220 320
41 139	39 55	74 16	79·8	39 44	72 59	78·9	39 32	71 43	78·1	39 19	70 27	77·3	39 06	69 12	76·5	38 51	67 57	75·7	221 319
42 138	40 53	74 02	79·4	40 41	72 45	78·5	40 29	71 27	77·7	40 16	70 10	76·9	40 02	68 54	76·1	39 47	67 38	75·3	222 318
43 137	41 51	73 48	79·0	41 39	72 29	78·2	41 26	71 11	77·3	41 12	69 53	76·4	40 58	68 35	75·6	40 42	67 19	74·7	223 317
44 136	42 48	73 32	78·6	42 36	72 12	77·7	42 23	70 53	76·9	42 09	69 34	76·0	41 54	68 16	75·1	41 38	66 58	74·2	224 316
45 135	43 46	73 16	78·3	43 33	71 55	77·3	43 19	70 35	76·4	43 05	69 15	75·5	42 49	67 56	74·6	42 33	66 37	73·7	225 315

Lat. / A		12°			13°			14°			15°			16°			17°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	43 46	73 16	78·3	43 33	71 55	77·3	43 19	70 35	76·4	43 05	69 15	75·5	42 49	67 56	74·6	42 33	66 37	73·7	225	315
46	134	44 43	72 59	77·8	44 30	71 37	76·9	44 16	70 15	75·9	44 01	68 54	75·0	43 45	67 34	74·1	43 28	66 15	73·2	226	314
47	133	45 40	72 41	77·4	45 27	71 18	76·4	45 12	69 55	75·5	44 57	68 33	74·5	44 40	67 12	73·5	44 23	65 51	72·6	227	313
48	132	46 38	72 23	77·0	46 24	70 58	76·0	46 09	69 34	75·0	45 53	68 11	74·0	45 35	66 48	73·0	45 17	65 27	72·0	228	312
49	131	47 35	72 03	76·5	47 20	70 37	75·5	47 05	69 11	74·4	46 48	67 47	73·4	46 30	66 23	72·4	46 12	65 01	71·4	229	311
50	130	48 32	71 42	76·1	48 17	70 15	75·0	48 01	68 48	73·9	47 44	67 22	72·9	47 25	65 58	71·8	47 06	64 34	70·8	230	310
51	129	49 29	71 20	75·6	49 13	69 51	74·5	48 57	68 23	73·4	48 39	66 56	72·3	48 20	65 30	71·2	48 00	64 05	70·1	231	309
52	128	50 25	70 57	75·1	50 09	69 27	73·9	49 52	67 57	72·8	49 34	66 29	71·7	49 15	65 02	70·6	48 54	63 35	69·5	232	308
53	127	51 22	70 33	74·6	51 06	69 01	73·4	50 48	67 30	72·2	50 29	66 00	71·0	50 09	64 31	69·9	49 48	63 04	68·8	233	307
54	126	52 19	70 07	74·0	52 02	68 33	72·8	51 43	67 01	71·6	51 24	65 30	70·4	51 03	64 00	69·2	50 41	62 31	68·1	234	306
55	125	53 15	69 40	73·5	52 57	68 04	72·2	52 38	66 30	70·9	52 18	64 58	69·7	51 57	63 26	68·5	51 34	61 56	67·3	235	305
56	124	54 11	69 11	72·9	53 53	67 34	71·6	53 33	65 58	70·3	53 12	64 24	69·0	52 50	62 51	67·8	52 27	61 20	66·6	236	304
57	123	55 07	68 41	72·2	54 48	67 02	70·9	54 28	65 24	69·6	54 06	63 48	68·3	53 43	62 14	67·0	53 19	60 42	65·8	237	303
58	122	56 03	68 09	71·6	55 43	66 28	70·2	55 22	64 48	68·8	55 00	63 11	67·5	54 36	61 35	66·2	54 12	60 01	64·9	238	302
59	121	56 59	67 34	70·9	56 38	65 51	69·5	56 16	64 10	68·1	55 53	62 31	66·7	55 29	60 54	65·4	55 03	59 18	64·1	239	301
60	120	57 54	66 58	70·2	57 33	65 13	68·7	57 10	63 30	67·3	56 46	61 49	65·9	56 21	60 10	64·5	55 55	58 33	63·1	240	300
61	119	58 49	66 20	69·4	58 27	64 32	67·9	58 04	62 47	66·4	57 39	61 04	65·0	57 13	59 24	63·6	56 46	57 46	62·2	241	299
62	118	59 44	65 38	68·6	59 21	63 49	67·1	58 57	62 02	65·5	58 31	60 17	64·0	58 05	58 35	62·6	57 36	56 56	61·2	242	298
63	117	60 38	64 55	67·8	60 15	63 03	66·2	59 50	61 13	64·6	59 23	59 27	63·1	58 55	57 43	61·6	58 26	56 03	60·2	243	297
64	116	61 32	64 08	66·9	61 08	62 14	65·2	60 42	60 22	63·6	60 15	58 34	62·0	59 46	56 49	60·5	59 16	55 06	59·1	244	296
65	115	62 26	63 18	66·0	62 01	61 21	64·2	61 34	59 28	62·6	61 06	57 37	61·0	60 36	55 51	59·4	60 05	54 07	57·9	245	295
66	114	63 20	62 25	65·0	62 53	60 25	63·2	62 26	58 30	61·5	61 56	56 37	59·8	61 25	54 49	58·2	60 53	53 04	56·7	246	294
67	113	64 13	61 27	63·9	63 45	59 25	62·1	63 16	57 27	60·3	62 46	55 34	58·6	62 14	53 44	57·0	61 41	51 57	55·4	247	293
68	112	65 05	60 26	62·8	64 37	58 21	60·9	64 07	56 21	59·1	63 35	54 25	57·4	63 02	52 34	55·7	62 27	50 47	54·1	248	292
69	111	65 57	59 20	61·6	65 27	57 13	59·6	64 56	55 10	57·8	64 23	53 13	56·0	63 49	51 20	54·3	63 14	49 32	52·7	249	291
70	110	66 48	58 08	60·3	66 18	55 59	58·3	65 45	53 55	56·4	65 11	51 55	54·6	64 36	50 01	52·9	63 59	48 12	51·2	250	290
71	109	67 39	56 52	58·9	67 07	54 40	56·8	66 33	52 33	54·9	65 58	50 33	53·1	65 21	48 38	51·3	64 43	46 48	49·7	251	289
72	108	68 29	55 29	57·4	67 55	53 14	55·3	67 20	51 06	53·3	66 44	49 04	51·5	66 06	47 08	49·7	65 26	45 18	48·0	252	288
73	107	69 18	53 59	55·8	68 43	51 42	53·7	68 07	49 33	51·6	67 29	47 30	49·8	66 49	45 33	48·0	66 08	43 43	46·3	253	287
74	106	70 06	52 22	54·1	69 30	50 03	51·9	68 52	47 52	49·8	68 12	45 49	47·9	67 31	43 52	46·1	66 49	42 02	44·4	254	286
75	105	70 53	50 36	52·2	70 15	48 16	50·0	69 36	46 04	47·9	68 55	44 00	46·0	68 12	42 04	44·2	67 29	40 15	42·5	255	285
76	104	71 38	48 42	50·2	70 59	46 20	47·9	70 18	44 08	45·9	69 36	42 05	43·9	68 52	40 09	42·1	68 07	38 21	40·5	256	284
77	103	72 23	46 37	48·0	71 42	44 15	45·7	70 59	42 03	43·7	70 15	40 01	41·7	69 30	38 07	39·9	68 43	36 21	38·3	257	283
78	102	73 06	44 22	45·6	72 23	42 00	43·4	71 38	39 49	41·3	70 53	37 49	39·4	70 06	35 57	37·6	69 18	34 13	36·0	258	282
79	101	73 47	41 55	43·1	73 02	39 34	40·8	72 16	37 26	38·8	71 28	35 27	36·9	70 40	33 38	35·2	69 50	31 58	33·6	259	281
80	100	74 26	39 15	40·3	73 39	36 57	38·1	72 51	34 51	36·1	72 02	32 57	34·3	71 12	31 12	32·6	70 21	29 36	31·1	260	280
81	99	75 02	36 21	37·3	74 14	34 07	35·1	73 24	32 06	33·2	72 34	30 17	31·5	71 42	28 37	29·9	70 50	27 06	28·4	261	279
82	98	75 37	33 13	34·1	74 46	31 05	32·0	73 55	29 10	30·2	73 03	27 27	28·5	72 09	25 53	27·0	71 16	24 29	25·7	262	278
83	97	76 08	29 50	30·6	75 16	27 50	28·6	74 23	26 03	26·9	73 29	24 27	25·4	72 34	23 02	24·0	71 39	21 44	22·8	263	277
84	96	76 36	26 11	26·8	75 42	24 22	25·0	74 48	22 45	23·5	73 52	21 19	22·1	72 56	20 02	20·9	72 00	18 53	19·8	264	276
85	95	77 01	22 18	22·8	76 05	20 41	21·3	75 09	19 16	19·9	74 12	18 01	18·7	73 15	16 54	17·6	72 18	15 55	16·7	265	275
86	94	77 22	18 10	18·6	76 25	16 49	17·3	75 27	15 38	16·1	74 29	14 36	15·1	73 31	13 40	14·2	72 33	12 51	13·5	266	274
87	93	77 38	13 50	14·1	76 40	12 46	13·1	75 41	11 51	12·2	74 43	11 03	11·4	73 44	10 21	10·8	72 45	9 43	10·2	267	273
88	92	77 50	9 19	9·5	76 51	8 36	8·8	75 52	7 58	8·2	74 52	7 25	7·7	73 53	6 56	7·2	72 53	6 31	6·8	268	272
89	91	77 58	4 42	4·8	76 58	4 19	4·4	75 58	4 00	4·1	74 58	3 44	3·9	73 58	3 29	3·6	72 58	3 16	3·4	269	271
90	90	78 00	0 00	0·0	77 00	0 00	0·0	76 00	0 00	0·0	75 00	0 00	0·0	74 00	0 00	0·0	73 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (–) for 90° < LHA < 270°
Dec:(–) for Lat. contrary name

Z_1: same sign as B
Z_2: (–) for F > 90°

Lat. / A	18°			19°			20°			21°			22°			23°			Lat. / A
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° °
0 180	0 00	72 00	90·0	0 00	71 00	90·0	0 00	70 00	90·0	0 00	69 00	90·0	0 00	68 00	90·0	0 00	67 00	90·0	180 360
1 179	0 57	72 00	89·7	0 57	71 00	89·7	0 56	70 00	89·7	0 56	69 00	89·6	0 56	68 00	89·6	0 55	67 00	89·6	181 359
2 178	1 54	71 59	89·4	1 53	70 59	89·3	1 53	69 59	89·3	1 52	68 59	89·3	1 51	67 59	89·3	1 50	66 59	89·2	182 358
3 177	2 51	71 59	89·1	2 50	70 59	89·0	2 49	69 58	89·0	2 48	68 58	88·9	2 47	67 58	88·9	2 46	66 58	88·8	183 357
4 176	3 48	71 58	88·8	3 47	70 57	88·7	3 46	69 57	88·6	3 44	68 57	88·6	3 42	67 57	88·5	3 41	66 57	88·4	184 356
5 175	4 45	71 56	88·5	4 44	70 56	88·4	4 42	69 56	88·3	4 40	68 56	88·2	4 38	67 55	88·1	4 36	66 55	88·0	185 355
6 174	5 42	71 54	88·1	5 40	70 54	88·0	5 38	69 54	87·9	5 36	68 54	87·8	5 34	67 53	87·7	5 31	66 53	87·6	186 354
7 173	6 39	71 52	87·8	6 37	70 52	87·7	6 35	69 52	87·6	6 32	68 51	87·5	6 29	67 51	87·4	6 26	66 51	87·3	187 353
8 172	7 36	71 50	87·5	7 34	70 50	87·4	7 31	69 49	87·2	7 28	68 49	87·1	7 25	67 48	87·0	7 22	66 48	86·9	188 352
9 171	8 33	71 47	87·2	8 30	70 47	87·0	8 27	69 46	86·9	8 24	68 46	86·8	8 20	67 45	86·6	8 17	66 45	86·5	189 351
10 170	9 30	71 44	86·9	9 27	70 44	86·7	9 23	69 43	86·5	9 20	68 42	86·4	9 16	67 42	86·2	9 12	66 41	86·1	190 350
11 169	10 27	71 41	86·6	10 24	70 40	86·4	10 20	69 39	86·2	10 16	68 39	86·0	10 11	67 38	85·8	10 07	66 37	85·7	191 349
12 168	11 24	71 37	86·2	11 20	70 36	86·0	11 16	69 35	85·8	11 12	68 34	85·6	11 07	67 33	85·4	11 02	66 32	85·3	192 348
13 167	12 21	71 33	85·9	12 17	70 32	85·7	12 12	69 31	85·5	12 07	68 30	85·3	12 02	67 29	85·1	11 57	66 28	84·8	193 347
14 166	13 18	71 29	85·6	13 13	70 28	85·4	13 08	69 26	85·1	13 03	68 25	84·9	12 58	67 24	84·7	12 52	66 22	84·4	194 346
15 165	14 15	71 24	85·3	14 10	70 23	85·0	14 05	69 21	84·8	13 59	68 20	84·5	13 53	67 18	84·3	13 47	66 17	84·0	195 345
16 164	15 12	71 19	84·9	15 06	70 18	84·7	15 01	69 16	84·4	14 55	68 14	84·1	14 48	67 12	83·9	14 42	66 10	83·6	196 344
17 163	16 09	71 14	84·6	16 03	70 12	84·3	15 57	69 10	84·0	15 50	68 08	83·7	15 44	67 06	83·5	15 37	66 04	83·2	197 343
18 162	17 05	71 08	84·3	16 59	70 06	84·0	16 53	69 03	83·7	16 46	68 01	83·4	16 39	66 59	83·1	16 32	65 57	82·8	198 342
19 161	18 02	71 02	83·9	17 56	69 59	83·6	17 49	68 57	83·3	17 42	67 54	83·0	17 34	66 52	82·7	17 26	65 49	82·3	199 341
20 160	18 59	70 56	83·6	18 52	69 53	83·2	18 45	68 50	82·9	18 37	67 47	82·6	18 29	66 44	82·2	18 21	65 41	81·9	200 340
21 159	19 56	70 49	83·2	19 48	69 45	82·9	19 41	68 42	82·5	19 33	67 39	82·2	19 24	66 36	81·8	19 16	65 33	81·5	201 339
22 158	20 52	70 41	82·9	20 45	69 38	82·5	20 37	68 34	82·1	20 28	67 31	81·8	20 19	66 27	81·4	20 10	65 24	81·0	202 338
23 157	21 49	70 33	82·5	21 41	69 29	82·1	21 32	68 26	81·7	21 24	67 22	81·4	21 14	66 18	81·0	21 05	65 15	80·6	203 337
24 156	22 45	70 25	82·2	22 37	69 21	81·8	22 28	68 17	81·3	22 19	67 12	80·9	22 09	66 09	80·5	21 59	65 05	80·1	204 336
25 155	23 42	70 17	81·8	23 33	69 12	81·4	23 24	68 07	80·9	23 14	67 03	80·5	23 04	65 58	80·1	22 54	64 54	79·7	205 335
26 154	24 38	70 07	81·4	24 29	69 02	81·0	24 20	67 57	80·5	24 09	66 52	80·1	23 59	65 48	79·6	23 48	64 43	79·2	206 334
27 153	25 35	69 58	81·1	25 25	68 52	80·6	25 15	67 47	80·1	25 05	66 42	79·7	24 54	65 36	79·2	24 42	64 32	78·7	207 333
28 152	26 31	69 48	80·7	26 21	68 42	80·2	26 11	67 36	79·7	26 00	66 30	79·2	25 48	65 25	78·7	25 36	64 19	78·3	208 332
29 151	27 27	69 37	80·3	27 17	68 31	79·8	27 06	67 24	79·3	26 55	66 18	78·8	26 43	65 12	78·3	26 30	64 07	77·8	209 331
30 150	28 24	69 26	79·9	28 13	68 19	79·4	28 01	67 12	78·8	27 50	66 06	78·3	27 37	64 59	77·8	27 24	63 53	77·3	210 330
31 149	29 20	69 14	79·5	29 09	68 07	78·9	28 57	67 00	78·4	28 44	65 53	77·8	28 31	64 46	77·3	28 18	63 39	76·8	211 329
32 148	30 16	69 02	79·1	30 04	67 54	78·5	29 52	66 46	77·9	29 39	65 39	77·4	29 26	64 32	76·8	29 12	63 25	76·3	212 328
33 147	31 12	68 49	78·7	31 00	67 41	78·1	30 47	66 32	77·5	30 34	65 24	76·9	30 20	64 17	76·3	30 05	63 09	75·8	213 327
34 146	32 08	68 36	78·2	31 55	67 27	77·6	31 42	66 18	77·0	31 28	65 09	76·4	31 14	64 01	75·8	30 59	62 53	75·2	214 326
35 145	33 04	68 22	77·8	32 51	67 12	77·2	32 37	66 03	76·5	32 23	64 54	75·9	32 08	63 45	75·3	31 52	62 36	74·7	215 325
36 144	33 59	68 07	77·3	33 46	66 57	76·7	33 32	65 47	76·0	33 17	64 37	75·4	33 01	63 28	74·8	32 45	62 19	74·2	216 324
37 143	34 55	67 52	76·9	34 41	66 41	76·2	34 26	65 30	75·5	34 11	64 20	74·9	33 55	63 10	74·2	33 38	62 01	73·6	217 323
38 142	35 50	67 36	76·4	35 36	66 24	75·7	35 21	65 13	75·0	35 05	64 02	74·4	34 48	62 51	73·7	34 31	61 41	73·0	218 322
39 141	36 46	67 19	76·0	36 31	66 06	75·2	36 15	64 54	74·5	35 59	63 43	73·8	35 42	62 32	73·1	35 24	61 21	72·4	219 321
40 140	37 41	67 01	75·5	37 26	65 48	74·7	37 10	64 35	74·0	36 53	63 23	73·3	36 35	62 12	72·6	36 17	61 01	71·8	220 320
41 139	38 36	66 42	75·0	38 20	65 29	74·2	38 04	64 15	73·4	37 46	63 02	72·7	37 28	61 50	72·0	37 09	60 39	71·2	221 319
42 138	39 31	66 23	74·5	39 15	65 08	73·7	38 58	63 54	72·9	38 40	62 41	72·1	38 21	61 28	71·4	38 01	60 16	70·6	222 318
43 137	40 26	66 03	73·9	40 09	64 47	73·1	39 51	63 33	72·3	39 33	62 18	71·5	39 13	61 05	70·7	38 53	59 52	70·0	223 317
44 136	41 21	65 42	73·4	41 03	64 25	72·5	40 45	63 10	71·7	40 26	61 55	70·9	40 06	60 41	70·1	39 45	59 27	69·3	224 316
45 135	42 16	65 19	72·8	41 57	64 02	72·0	41 38	62 46	71·1	41 19	61 30	70·3	40 58	60 15	69·5	40 37	59 01	68·7	225 315

Lat. / A		18°			19°			20°			21°			22°			23°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	42 16	65 19	72·8	41 57	64 02	72·0	41 38	62 46	71·1	41 19	61 30	70·3	40 58	60 15	69·5	40 37	59 01	68·7	225	315
46	134	43 10	64 56	72·3	42 51	63 38	71·4	42 32	62 21	70·5	42 11	61 05	69·6	41 50	59 49	68·8	41 28	58 34	68·0	226	314
47	133	44 04	64 32	71·7	43 45	63 13	70·8	43 25	61 55	69·9	43 04	60 38	69·0	42 42	59 21	68·1	42 19	58 06	67·3	227	313
48	132	44 58	64 06	71·1	44 38	62 46	70·1	44 18	61 27	69·2	43 56	60 09	68·3	43 33	58 53	67·4	43 10	57 37	66·5	228	312
49	131	45 52	63 39	70·4	45 32	62 18	69·5	45 10	60 59	68·5	44 48	59 40	67·6	44 24	58 22	66·7	44 00	57 06	65·8	229	311
50	130	46 46	63 11	69·8	46 25	61 49	68·8	46 03	60 29	67·8	45 39	59 09	66·9	45 15	57 51	65·9	44 50	56 34	65·0	230	310
51	129	47 39	62 42	69·1	47 17	61 19	68·1	46 55	59 57	67·1	46 31	58 37	66·1	46 06	57 18	65·2	45 40	56 00	64·2	231	309
52	128	48 33	62 11	68·4	48 10	60 47	67·4	47 46	59 25	66·4	47 22	58 03	65·4	46 56	56 44	64·4	46 30	55 25	63·4	232	308
53	127	49 25	61 38	67·7	49 02	60 13	66·6	48 38	58 50	65·6	48 13	57 28	64·6	47 46	56 07	63·6	47 19	54 48	62·6	233	307
54	126	50 18	61 04	67·0	49 54	59 38	65·9	49 29	58 14	64·8	49 03	56 51	63·7	48 36	55 30	62·7	48 08	54 10	61·7	234	306
55	125	51 10	60 28	66·2	50 46	59 01	65·1	50 20	57 36	64·0	49 53	56 12	62·9	49 25	54 50	61·9	48 56	53 30	60·8	235	305
56	124	52 03	59 50	65·4	51 37	58 23	64·2	51 10	56 56	63·1	50 43	55 32	62·0	50 14	54 09	61·0	49 44	52 48	59·9	236	304
57	123	52 54	59 11	64·6	52 28	57 42	63·4	52 00	56 15	62·2	51 32	54 49	61·1	51 02	53 26	60·0	50 32	52 04	59·0	237	303
58	122	53 46	58 29	63·7	53 18	56 59	62·5	52 50	55 31	61·3	52 21	54 05	60·2	51 50	52 41	59·1	51 19	51 18	58·0	238	302
59	121	54 37	57 45	62·8	54 08	56 14	61·5	53 39	54 45	60·4	53 09	53 18	59·2	52 38	51 53	58·1	52 06	50 30	57·0	239	301
60	120	55 27	56 59	61·8	54 58	55 27	60·6	54 28	53 57	59·4	53 57	52 29	58·2	53 25	51 04	57·0	52 52	49 40	55·9	240	300
61	119	56 17	56 10	60·9	55 47	54 37	59·6	55 16	53 06	58·3	54 44	51 38	57·1	54 11	50 12	55·9	53 37	48 48	54·8	241	299
62	118	57 07	55 19	59·8	56 36	53 45	58·5	56 04	52 13	57·2	55 31	50 44	56·0	54 57	49 17	54·8	54 22	47 53	53·7	242	298
63	117	57 56	54 25	58·8	57 24	52 49	57·4	56 51	51 17	56·1	56 17	49 47	54·9	55 42	48 20	53·7	55 06	46 55	52·5	243	297
64	116	58 44	53 27	57·6	58 12	51 51	56·3	57 38	50 18	55·0	57 03	48 48	53·7	56 27	47 20	52·5	55 50	45 55	51·3	244	296
65	115	59 32	52 27	56·5	58 58	50 50	55·1	58 24	49 16	53·7	57 47	47 45	52·5	57 10	46 17	51·2	56 32	44 52	50·0	245	295
66	114	60 19	51 23	55·2	59 45	49 45	53·8	59 09	48 11	52·5	58 32	46 39	51·2	57 53	45 11	49·9	57 14	43 47	48·7	246	294
67	113	61 06	50 15	53·9	60 30	48 37	52·5	59 53	47 02	51·1	59 15	45 30	49·8	58 36	44 02	48·6	57 55	42 38	47·4	247	293
68	112	61 52	49 04	52·6	61 15	47 25	51·1	60 36	45 50	49·8	59 57	44 18	48·4	59 17	42 50	47·2	58 36	41 26	46·0	248	292
69	111	62 37	47 48	51·2	61 58	46 09	49·7	61 19	44 33	48·3	60 39	43 02	47·0	59 57	41 34	45·7	59 15	40 10	44·5	249	291
70	110	63 21	46 28	49·7	62 41	44 48	48·2	62 01	43 13	46·8	61 19	41 42	45·4	60 36	40 15	44·2	59 53	38 52	43·0	250	290
71	109	64 04	45 03	48·1	63 23	43 24	46·6	62 41	41 49	45·2	61 58	40 18	43·9	61 15	38 52	42·6	60 30	37 29	41·4	251	289
72	108	64 45	43 34	46·4	64 04	41 54	44·9	63 21	40 20	43·5	62 37	38 50	42·2	61 52	37 25	40·9	61 06	36 03	39·7	252	288
73	107	65 26	41 59	44·7	64 43	40 20	43·2	63 59	38 46	41·8	63 14	37 18	40·5	62 27	35 53	39·2	61 41	34 34	38·0	253	287
74	106	66 06	40 19	42·9	65 21	38 41	41·4	64 36	37 08	40·0	63 49	35 41	38·7	63 02	34 18	37·4	62 14	33 00	36·3	254	286
75	105	66 44	38 32	40·9	65 58	36 56	39·5	65 11	35 25	38·1	64 23	33 59	36·8	63 35	32 39	35·6	62 46	31 22	34·4	255	285
76	104	67 20	36 40	38·9	66 33	35 05	37·4	65 45	33 37	36·1	64 56	32 13	34·8	64 07	30 55	33·6	63 16	29 41	32·5	256	284
77	103	67 55	34 42	36·8	67 07	33 09	35·3	66 18	31 43	34·0	65 27	30 22	32·8	64 37	29 06	31·6	63 45	27 55	30·6	257	283
78	102	68 29	32 37	34·5	67 39	31 07	33·1	66 48	29 44	31·9	65 57	28 26	30 7	65 05	27 14	29·6	64 13	26 06	28·5	258	282
79	101	69 00	30 25	32·2	68 09	29 00	30·8	67 17	27 40	29·6	66 25	26 26	28·5	65 32	25 17	27·4	64 38	24 12	26·4	259	281
80	100	69 29	28 07	29·7	68 37	26 46	28·4	67 44	25 30	27·3	66 50	24 20	26·2	65 56	23 15	25·2	65 02	22 15	24·3	260	280
81	99	69 57	25 43	27·1	69 03	24 26	25·9	68 09	23 15	24·8	67 14	22 10	23·8	66 19	21 10	22·9	65 23	20 14	22·1	261	279
82	98	70 21	23 11	24·5	69 27	22 00	23·3	68 31	20 56	22·3	67 36	19 56	21·4	66 40	19 00	20·6	65 43	18 09	19·8	262	278
83	97	70 44	20 34	21·7	69 48	19 29	20·7	68 51	18 31	19·7	67 55	17 37	18·9	66 58	16 47	18·1	66 01	16 01	17·4	263	277
84	96	71 03	17 50	18·8	70 07	16 53	17·9	69 09	16 01	17·1	68 12	15 14	16·3	67 14	14 30	15·7	66 16	13 50	15·1	264	276
85	95	71 20	15 01	15·8	70 23	14 12	15·0	69 25	13 28	14·3	68 26	12 48	13·7	67 28	12 10	13·1	66 29	11 36	12·6	265	275
86	94	71 35	12 07	12·8	70 36	11 27	12·1	69 37	10 51	11·6	68 38	10 18	11·0	67 39	9 48	10·6	66 40	9 20	10·1	266	274
87	93	71 46	9 09	9·6	70 46	8 39	9·1	69 47	8 11	8·7	68 48	7 46	8·3	67 48	7 23	8·0	66 49	7 02	7·6	267	273
88	92	71 54	6 08	6·4	70 54	5 47	6·1	69 54	5 29	5·8	68 55	5 12	5·6	67 55	4 56	5·3	66 55	4 42	5·1	268	272
89	91	71 58	3 04	3·2	70 58	2 54	3·1	69 59	2 45	2·9	68 59	2 36	2·8	67 59	2 28	2·7	66 59	2 21	2·6	269	271
90	90	72 00	0 00	0·0	71 00	0 00	0·0	70 00	0 00	0·0	69 00	0 00	0·0	68 00	0 00	0·0	67 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (−) for 90° < LHA < 270°
Dec:(−) for Lat. contrary name

Z_1: same sign as B
Z_2: (−) for F > 90°

Lat. / A		24°			25°			26°			27°			28°			29°			Lat. / A	
LHA	F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
0	180	0 00	66 00	90·0	0 00	65 00	90·0	0 00	64 00	90·0	0 00	63 00	90·0	0 00	62 00	90·0	0 00	61 00	90·0	180	360
1	179	0 55	66 00	89·6	0 54	65 00	89·6	0 54	64 00	89·6	0 53	63 00	89·5	0 53	62 00	89·5	0 52	61 00	89·5	181	359
2	178	1 50	65 59	89·2	1 49	64 59	89·2	1 48	63 59	89·1	1 47	62 59	89·1	1 46	61 59	89·1	1 45	60 59	89·0	182	358
3	177	2 44	65 58	88·8	2 43	64 58	88·7	2 42	63 58	88·7	2 40	62 58	88·6	2 39	61 58	88·6	2 37	60 58	88·5	183	357
4	176	3 39	65 57	88·4	3 37	64 57	88·3	3 36	63 57	88·2	3 34	62 57	88·2	3 32	61 57	88·1	3 30	60 56	88·1	184	356
5	175	4 34	65 55	88·0	4 32	64 55	87·9	4 30	63 55	87·8	4 27	62 55	87·7	4 25	61 55	87·6	4 22	60 54	87·6	185	355
6	174	5 29	65 53	87·6	5 26	64 53	87·5	5 23	63 53	87·4	5 21	62 52	87·3	5 18	61 52	87·2	5 15	60 52	87·1	186	354
7	173	6 24	65 50	87·1	6 20	64 50	87·0	6 17	63 50	86·9	6 14	62 50	86·8	6 11	61 49	86·7	6 07	60 49	86·6	187	353
8	172	7 18	65 47	86·7	7 15	64 47	86·6	7 11	63 47	86·5	7 07	62 46	86·3	7 04	61 46	86·2	6 59	60 46	86·1	188	352
9	171	8 13	65 44	86·3	8 09	64 44	86·2	8 05	63 43	86·0	8 01	62 43	85·9	7 56	61 42	85·7	7 52	60 42	85·6	189	351
10	170	9 08	65 40	85·9	9 03	64 40	85·7	8 59	63 39	85·6	8 54	62 39	85·4	8 49	61 38	85·3	8 44	60 38	85·1	190	350
11	169	10 02	65 36	85·5	9 57	64 35	85·3	9 52	63 35	85·1	9 47	62 34	85·0	9 42	61 33	84·8	9 36	60 33	84·6	191	349
12	168	10 57	65 32	85·1	10 52	64 31	84·9	10 46	63 30	84·7	10 41	62 29	84·5	10 35	61 28	84·3	10 29	60 28	84·1	192	348
13	167	11 52	65 27	84·6	11 46	64 26	84·4	11 40	63 25	84·2	11 34	62 24	84·0	11 27	61 23	83·8	11 21	60 22	83·6	193	347
14	166	12 46	65 21	84·2	12 40	64 20	84·0	12 34	63 19	83·8	12 27	62 18	83·5	12 20	61 17	83·3	12 13	60 16	83·1	194	346
15	165	13 41	65 15	83·8	13 34	64 14	83·5	13 27	63 13	83·3	13 20	62 11	83·1	13 13	61 10	82·8	13 05	60 09	82·6	195	345
16	164	14 35	65 09	83·3	14 28	64 07	83·1	14 21	63 06	82·8	14 13	62 04	82·6	14 05	61 03	82·3	13 57	60 02	82·1	196	344
17	163	15 29	65 02	82·9	15 22	64 00	82·6	15 14	62 59	82·4	15 06	61 57	82·1	14 58	60 56	81·8	14 49	59 54	81·6	197	343
18	162	16 24	64 55	82·5	16 16	63 53	82·2	16 08	62 51	81·9	15 59	61 49	81·6	15 50	60 47	81·3	15 41	59 46	81·0	198	342
19	161	17 18	64 47	82·0	17 10	63 45	81·7	17 01	62 43	81·4	16 52	61 41	81·1	16 42	60 39	80·8	16 33	59 37	80·5	199	341
20	160	18 12	64 39	81·6	18 03	63 36	81·3	17 54	62 34	80·9	17 45	61 32	80·6	17 35	60 30	80·3	17 24	59 28	80·0	200	340
21	159	19 07	64 30	81·1	18 57	63 28	80·8	18 47	62 25	80·4	18 37	61 23	80·1	18 27	60 20	79·8	18 16	59 18	79·5	201	339
22	158	20 01	64 21	80·7	19 51	63 18	80·3	19 41	62 15	80·0	19 30	61 13	79·6	19 19	60 10	79·3	19 08	59 08	78·9	202	338
23	157	20 55	64 11	80·2	20 44	63 08	79·8	20 34	62 05	79·5	20 22	61 02	79·1	20 11	59 59	78·7	19 59	58 57	78·4	203	337
24	156	21 49	64 01	79·7	21 38	62 58	79·3	21 27	61 54	79·0	21 15	60 51	78·6	21 03	59 48	78·2	20 50	58 45	77·8	204	336
25	155	22 43	63 50	79·3	22 31	62 46	78·9	22 19	61 43	78·4	22 07	60 39	78·0	21 55	59 36	77·7	21 42	58 33	77·3	205	335
26	154	23 36	63 39	78·8	23 25	62 35	78·4	23 12	61 31	77·9	22 59	60 27	77·5	22 46	59 24	77·1	22 33	58 20	76·7	206	334
27	153	24 30	63 27	78·3	24 18	62 22	77·8	24 05	61 18	77·4	23 52	60 14	77·0	23 38	59 10	76·5	23 24	58 07	76·1	207	333
28	152	25 24	63 14	77·8	25 11	62 10	77·3	24 57	61 05	76·9	24 44	60 01	76·4	24 29	58 57	76·0	24 15	57 53	75·5	208	332
29	151	26 17	63 01	77·3	26 04	61 56	76·8	25 50	60 51	76·3	25 36	59 47	75·9	25 21	58 42	75·4	25 05	57 38	75·0	209	331
30	150	27 11	62 48	76·8	26 57	61 42	76·3	26 42	60 37	75·8	26 27	59 32	75·3	26 12	58 27	74·8	25 56	57 23	74·4	210	330
31	149	28 04	62 33	76·3	27 50	61 27	75·8	27 35	60 22	75·2	27 19	59 16	74·7	27 03	58 11	74·2	26 46	57 07	73·8	211	329
32	148	28 57	62 18	75·7	28 42	61 12	75·2	28 27	60 06	74·7	28 10	59 00	74·2	27 54	57 55	73·7	27 37	56 50	73·1	212	328
33	147	29 50	62 02	75·2	29 35	60 56	74·7	29 19	59 49	74·1	29 02	58 43	73·6	28 45	57 38	73·0	28 27	56 32	72·5	213	327
34	146	30 43	61 46	74·7	30 27	60 39	74·1	30 10	59 32	73·5	29 53	58 26	73·0	29 35	57 20	72·4	29 17	56 14	71·9	214	326
35	145	31 36	61 28	74·1	31 19	60 21	73·5	31 02	59 14	72·9	30 44	58 07	72·4	30 26	57 01	71·8	30 07	55 55	71·2	215	325
36	144	32 29	61 10	73·5	32 11	60 02	72·9	31 53	58 55	72·3	31 35	57 48	71·7	31 16	56 41	71·2	30 56	55 35	70·6	216	324
37	143	33 21	60 52	73·0	33 03	59 43	72·3	32 45	58 35	71·7	32 26	57 28	71·1	32 06	56 21	70·5	31 46	55 14	69·9	217	323
38	142	34 13	60 32	72·4	33 55	59 23	71·7	33 36	58 15	71·1	33 16	57 07	70·5	32 56	55 59	69·9	32 35	54 53	69·3	218	322
39	141	35 06	60 11	71·8	34 47	59 02	71·1	34 27	57 53	70·5	34 06	56 45	69·8	33 45	55 37	69·2	33 24	54 30	68·6	219	321
40	140	35 58	59 50	71·2	35 38	58 40	70·5	35 17	57 31	69·8	34 56	56 22	69·1	34 35	55 14	68·5	34 12	54 07	67·9	220	320
41	139	36 49	59 28	70·5	36 29	58 17	69·8	36 08	57 08	69·1	35 46	55 59	68·5	35 24	54 50	67·8	35 01	53 42	67·1	221	319
42	138	37 41	59 04	69·9	37 20	57 54	69·2	36 58	56 43	68·5	36 36	55 34	67·8	36 13	54 25	67·1	35 49	53 17	66·4	222	318
43	137	38 32	58 40	69·2	38 11	57 29	68·5	37 48	56 18	67·8	37 25	55 08	67·1	37 02	53 59	66·4	36 37	52 50	65·7	223	317
44	136	39 23	58 15	68·6	39 01	57 03	67·8	38 38	55 52	67·1	38 14	54 41	66·3	37 50	53 32	65·6	37 25	52 23	64·9	224	316
45	135	40 14	57 48	67·9	39 51	56 36	67·1	39 28	55 24	66·3	39 03	54 13	65·6	38 38	53 04	64·9	38 12	51 54	64·1	225	315

Lat. / A		24°			25°			26°			27°			28°			29°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	40 14	57 48	67·9	39 51	56 36	67·1	39 28	55 24	66·3	39 03	54 13	65·6	38 38	53 04	64·9	38 12	51 54	64·1	225	315
46	134	41 05	57 21	67·2	40 41	56 08	66·4	40 17	54 56	65·6	39 52	53 44	64·8	39 26	52 34	64·1	38 59	51 25	63·3	226	314
47	133	41 55	56 52	66·4	41 31	55 38	65·6	41 06	54 26	64·8	40 40	53 14	64·0	40 13	52 04	63·3	39 46	50 54	62·5	227	313
48	132	42 45	56 22	65·7	42 20	55 08	64·9	41 54	53 55	64·0	41 28	52 43	63·2	41 00	51 32	62·5	40 32	50 22	61·7	228	312
49	131	43 35	55 50	64·9	43 09	54 36	64·1	42 43	53 22	63·2	42 15	52 10	62·4	41 47	50 59	61·6	41 18	49 48	60·9	229	311
50	130	44 25	55 17	64·1	43 58	54 02	63·3	43 31	52 49	62·4	43 03	51 36	61·6	42 34	50 24	60·8	42 04	49 14	60·0	230	310
51	129	45 14	54 43	63·3	44 47	53 28	62·4	44 18	52 13	61·6	43 49	51 00	60·7	43 20	49 48	59·9	42 49	48 38	59·1	231	309
52	128	46 03	54 08	62·5	45 35	52 52	61·6	45 06	51 37	60·7	44 36	50 23	59·8	44 05	49 11	59·0	43 34	48 00	58·2	232	308
53	127	46 51	53 30	61·6	46 22	52 14	60·7	45 52	50 59	59·8	45 22	49 45	58·9	44 51	48 32	58·1	44 18	47 21	57·2	233	307
54	126	47 39	52 51	60·8	47 09	51 34	59·8	46 39	50 19	58·9	46 07	49 05	58·0	45 35	47 52	57·1	45 02	46 41	56·3	234	306
55	125	48 27	52 11	59·8	47 56	50 53	58·9	47 25	49 37	58·0	46 53	48 23	57·0	46 19	47 10	56·2	45 46	45 59	55·3	235	305
56	124	49 14	51 28	58·9	48 43	50 11	57·9	48 10	48 54	57·0	47 37	47 40	56·1	47 03	46 27	55·2	46 29	45 15	54·3	236	304
57	123	50 01	50 44	57·9	49 28	49 26	56·9	48 55	48 09	56·0	48 21	46 54	55·0	47 46	45 41	54·1	47 11	44 30	53·3	237	303
58	122	50 47	49 58	56·9	50 14	48 39	55·9	49 40	47 22	54·9	49 05	46 07	54·0	48 29	44 54	53·1	47 53	43 43	52·2	238	302
59	121	51 33	49 09	55·9	50 58	47 51	54·9	50 23	46 34	53·9	49 48	45 18	52·9	49 11	44 05	52·0	48 34	42 54	51·1	239	301
60	120	52 18	48 19	54·8	51 43	47 00	53·8	51 07	45 43	52·8	50 30	44 28	51·8	49 53	43 14	50·9	49 14	42 03	50·0	240	300
61	119	53 02	47 26	53·7	52 26	46 07	52·7	51 49	44 50	51·7	51 12	43 35	50·7	50 33	42 22	49·7	49 54	41 10	48·8	241	299
62	118	53 46	46 31	52·6	53 09	45 12	51·5	52 31	43 54	50·5	51 53	42 39	49·5	51 13	41 27	48·6	50 33	40 16	47·6	242	298
63	117	54 29	45 33	51·4	53 51	44 14	50·3	53 13	42 57	49·3	52 33	41 42	48·3	51 53	40 30	47·3	51 12	39 19	46·4	243	297
64	116	55 12	44 33	50·2	54 33	43 14	49·1	53 53	41 57	48·1	53 13	40 42	47·1	52 31	39 30	46·1	51 49	38 20	45·2	244	296
65	115	55 53	43 30	48·9	55 13	42 11	47·8	54 33	40 55	46·8	53 51	39 40	45·8	53 09	38 29	44·8	52 26	37 19	43·9	245	295
66	114	56 34	42 25	47·6	55 53	41 06	46·5	55 12	39 50	45·4	54 29	38 36	44·4	53 46	37 25	43·5	53 02	36 16	42·6	246	294
67	113	57 14	41 16	46·2	56 32	39 58	45·1	55 50	38 42	44·1	55 06	37 29	43·1	54 22	36 19	42·1	53 37	35 11	41·2	247	293
68	112	57 53	40 05	44·8	57 10	38 47	43·7	56 27	37 32	42·7	55 42	36 19	41·7	54 57	35 10	40·7	54 11	34 03	39·8	248	292
69	111	58 32	38 50	43·3	57 47	37 33	42·2	57 03	36 18	41·2	56 17	35 07	40·2	55 31	33 59	39·3	54 44	32 53	38·4	249	291
70	110	59 09	37 32	41·8	58 24	36 16	40·7	57 38	35 02	39·7	56 51	33 52	38·7	56 04	32 45	37·8	55 16	31 41	36·9	250	290
71	109	59 45	36 11	40·2	58 58	34 55	39·2	58 12	33 43	38·1	57 24	32 35	37·2	56 36	31 29	36·3	55 47	30 26	35·4	251	289
72	108	60 19	34 46	38·6	59 32	33 32	37·6	58 44	32 21	36·5	57 56	31 14	35·6	57 07	30 10	34·7	56 17	29 08	33·8	252	288
73	107	60 53	33 18	36·9	60 05	32 05	35·9	59 16	30 56	34·9	58 26	29 51	34·0	57 36	28 48	33·1	56 46	27 49	32·2	253	287
74	106	61 25	31 46	35·2	60 36	30 35	34·2	59 46	29 28	33·2	58 55	28 25	32·3	58 05	27 24	31·4	57 13	26 26	30·6	254	286
75	105	61 56	30 10	33·4	61 06	29 02	32·4	60 15	27 57	31·4	59 23	26 56	30·5	58 31	25 57	29·7	57 39	25 02	28·9	255	285
76	104	62 26	28 31	31·5	61 34	27 25	30·5	60 42	26 23	29·6	59 50	25 24	28·8	58 57	24 28	28·0	58 04	23 35	27·2	256	284
77	103	62 53	26 48	29·6	62 01	25 45	28·6	61 08	24 46	27·8	60 15	23 49	27·0	59 21	22 56	26·2	58 27	22 05	25·5	257	283
78	102	63 20	25 02	27·6	62 26	24 02	26·7	61 32	23 05	25·9	60 38	22 12	25·1	59 44	21 21	24·4	58 49	20 34	23·7	258	282
79	101	63 44	23 12	25·5	62 50	22 15	24·7	61 55	21 22	23·9	61 00	20 32	23·2	60 05	19 44	22·5	59 09	19 00	21·8	259	281
80	100	64 07	21 18	23·4	63 12	20 25	22·6	62 16	19 36	21·9	61 20	18 49	21·2	60 24	18 05	20·6	59 28	17 24	20·0	260	280
81	99	64 28	19 22	21·3	63 32	18 33	20·5	62 35	17 47	19·9	61 39	17 04	19·2	60 42	16 24	18·6	59 45	15 46	18·1	261	279
82	98	64 47	17 22	19·1	63 50	16 37	18·4	62 53	15 56	17·8	61 56	15 17	17·2	60 58	14 40	16·7	60 01	14 06	16·2	262	278
83	97	65 03	15 18	16·8	64 06	14 39	16·2	63 08	14 02	15·6	62 10	13 27	15·1	61 12	12 55	14·7	60 14	12 24	14·2	263	277
84	96	65 18	13 13	14·5	64 20	12 38	14·0	63 22	12 06	13·5	62 23	11 36	13·0	61 25	11 07	12·6	60 26	10 41	12·2	264	276
85	95	65 31	11 05	12·1	64 32	10 35	11·7	63 33	10 08	11·3	62 35	9 42	10·9	61 36	9 19	10·6	60 37	8 56	10·2	265	275
86	94	65 41	8 54	9·8	64 42	8 30	9·4	63 43	8 08	9·1	62 44	7 48	8·8	61 44	7 28	8·5	60 45	7 10	8·2	266	274
87	93	65 49	6 42	7·3	64 50	6 24	7·1	63 50	6 07	6·8	62 51	5 52	6·6	61 51	5 37	6·4	60 52	5 24	6·2	267	273
88	92	65 55	4 29	4·9	64 56	4 17	4·7	63 56	4 06	4·6	62 56	3 55	4·4	61 56	3 45	4·3	60 56	3 36	4·1	268	272
89	91	65 59	2 15	2·5	64 59	2 09	2·4	63 59	2 03	2·3	62 59	1 58	2·2	61 59	1 53	2·1	60 59	1 48	2·1	269	271
90	90	66 00	0 00	0·0	65 00	0 00	0·0	64 00	0 00	0·0	63 00	0 00	0·0	62 00	0 00	0·0	61 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (–) for 90° < LHA < 270°
Dec:(–) for Lat. contrary name

Z_1: same sign as B
Z_2: (–) for F > 90°

Lat. / A	30°			31°			32°			33°			34°			35°			Lat. / A
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° °
0 180	0 00	60 00	90·0	0 00	59 00	90·0	0 00	58 00	90·0	0 00	57 00	90·0	0 00	56 00	90·0	0 00	55 00	90·0	180 360
1 179	0 52	60 00	89·5	0 51	59 00	89·5	0 51	58 00	89·5	0 50	57 00	89·5	0 50	56 00	89·4	0 49	55 00	89·4	181 359
2 178	1 44	59 59	89·0	1 43	58 59	89·0	1 42	57 59	88·9	1 41	56 59	88·9	1 39	55 59	88·9	1 38	54 59	88·9	182 358
3 177	2 36	59 58	88·5	2 34	58 58	88·5	2 33	57 58	88·4	2 31	56 58	88·4	2 29	55 58	88·3	2 27	54 58	88·3	183 357
4 176	3 28	59 56	88·0	3 26	58 56	87·9	3 23	57 56	87·9	3 21	56 56	87·8	3 19	55 56	87·8	3 17	54 56	87·7	184 356
5 175	4 20	59 54	87·5	4 17	58 54	87·4	4 14	57 54	87·3	4 12	56 54	87·3	4 09	55 54	87·2	4 06	54 54	87·1	185 355
6 174	5 12	59 52	87·0	5 08	58 52	86·9	5 05	57 52	86·8	5 02	56 51	86·7	4 58	55 51	86·6	4 55	54 51	86·6	186 354
7 173	6 04	59 49	86·5	6 00	58 49	86·4	5 56	57 48	86·3	5 52	56 48	86·2	5 48	55 48	86·1	5 44	54 48	86·0	187 353
8 172	6 55	59 45	86·0	6 51	58 45	85·9	6 47	57 45	85·7	6 42	56 45	85·6	6 38	55 44	85·5	6 33	54 44	85·4	188 352
9 171	7 47	59 42	85·5	7 42	58 41	85·3	7 37	57 41	85·2	7 32	56 40	85·1	7 27	55 40	84·9	7 22	54 40	84·8	189 351
10 170	8 39	59 37	85·0	8 34	58 37	84·8	8 28	57 36	84·7	8 22	56 36	84·5	8 17	55 36	84·4	8 11	54 35	84·2	190 350
11 169	9 31	59 32	84·4	9 25	58 32	84·3	9 19	57 31	84·1	9 13	56 31	84·0	9 06	55 30	83·8	9 00	54 30	83·6	191 349
12 168	10 22	59 27	83·9	10 16	58 26	83·8	10 09	57 26	83·6	10 03	56 25	83·4	9 56	55 25	83·2	9 48	54 24	83·0	192 348
13 167	11 14	59 21	83·4	11 07	58 20	83·2	11 00	57 20	83·0	10 52	56 19	82·8	10 45	55 18	82·6	10 37	54 18	82·5	193 347
14 166	12 06	59 15	82·9	11 58	58 14	82·7	11 50	57 13	82·5	11 42	56 12	82·3	11 34	55 12	82·1	11 26	54 11	81·9	194 346
15 165	12 57	59 08	82·4	12 49	58 07	82·1	12 41	57 06	81·9	12 32	56 05	81·7	12 23	55 04	81·5	12 14	54 04	81·3	195 345
16 164	13 49	59 01	81·8	13 40	57 59	81·6	13 31	56 58	81·4	13 22	55 57	81·1	13 13	54 57	80·9	13 03	53 56	80·7	196 344
17 163	14 40	58 53	81·3	14 31	57 51	81·1	14 21	56 50	80·8	14 12	55 49	80·5	14 02	54 48	80·3	13 51	53 47	80·1	197 343
18 162	15 31	58 44	80·8	15 22	57 43	80·5	15 12	56 42	80·2	15 01	55 40	80·0	14 51	54 39	79·7	14 40	53 38	79·4	198 342
19 161	16 23	58 35	80·2	16 12	57 34	79·9	16 02	56 32	79·7	15 51	55 31	79·4	15 40	54 30	79·1	15 28	53 29	78·8	199 341
20 160	17 14	58 26	79·7	17 03	57 24	79·4	16 52	56 23	79·1	16 40	55 21	78·8	16 28	54 20	78·5	16 16	53 19	78·2	200 340
21 159	18 05	58 16	79·1	17 53	57 14	78·8	17 42	56 12	78·5	17 29	55 11	78·2	17 17	54 09	77·9	17 04	53 08	77·6	201 339
22 158	18 56	58 05	78·6	18 44	57 03	78·2	18 31	56 01	77·9	18 19	55 00	77·6	18 06	53 58	77·3	17 52	52 56	77·0	202 338
23 157	19 47	57 54	78·0	19 34	56 52	77·7	19 21	55 50	77·3	19 08	54 48	77·0	18 54	53 46	76·6	18 40	52 44	76·3	203 337
24 156	20 37	57 42	77·4	20 24	56 40	77·1	20 11	55 38	76·7	19 57	54 36	76·4	19 42	53 34	76·0	19 28	52 32	75·7	204 336
25 155	21 28	57 30	76·9	21 14	56 27	76·5	21 00	55 25	76·1	20 46	54 23	75·7	20 31	53 21	75·4	20 15	52 19	75·0	205 335
26 154	22 19	57 17	76·3	22 04	56 14	75·9	21 49	55 12	75·5	21 34	54 09	75·1	21 19	53 07	74·7	21 03	52 05	74·4	206 334
27 153	23 09	57 03	75·7	22 54	56 00	75·3	22 39	54 57	74·9	22 23	53 55	74·5	22 07	52 52	74·1	21 50	51 50	73·7	207 333
28 152	23 59	56 49	75·1	23 44	55 46	74·7	23 28	54 43	74·3	23 11	53 40	73·8	22 54	52 37	73·4	22 37	51 35	73·0	208 332
29 151	24 50	56 34	74·5	24 33	55 31	74·1	24 17	54 27	73·6	23 59	53 24	73·2	23 42	52 22	72·8	23 24	51 19	72·4	209 331
30 150	25 40	56 19	73·9	25 23	55 15	73·4	25 05	54 11	73·0	24 48	53 08	72·5	24 29	52 05	72·1	24 11	51 03	71·7	210 330
31 149	26 29	56 02	73·3	26 12	54 58	72·8	25 54	53 54	72·3	25 35	52 51	71·9	25 17	51 48	71·4	24 57	50 45	71·0	211 329
32 148	27 19	55 45	72·6	27 01	54 41	72·2	26 42	53 37	71·7	26 23	52 33	71·2	26 04	51 30	70·7	25 44	50 27	70·3	212 328
33 147	28 09	55 27	72·0	27 50	54 23	71·5	27 31	53 19	71·0	27 11	52 15	70·5	26 50	51 12	70·0	26 30	50 08	69·6	213 327
34 146	28 58	55 09	71·4	28 38	54 04	70·8	28 19	53 00	70·3	27 58	51 56	69·8	27 37	50 52	69·3	27 16	49 49	68·8	214 326
35 145	29 47	54 49	70·7	29 27	53 44	70·2	29 06	52 40	69·6	28 45	51 36	69·1	28 24	50 32	68·6	28 01	49 29	68·1	215 325
36 144	30 36	54 29	70·0	30 15	53 24	69·5	29 54	52 19	68·9	29 32	51 15	68·4	29 10	50 11	67·9	28 47	49 07	67·4	216 324
37 143	31 25	54 08	69·4	31 03	53 03	68·8	30 41	51 58	68·2	30 19	50 53	67·7	29 56	49 49	67·2	29 32	48 45	66·6	217 323
38 142	32 13	53 46	68·7	31 51	52 40	68·1	31 28	51 35	67·5	31 05	50 30	66·9	30 41	49 26	66·4	30 17	48 23	65·9	218 322
39 141	33 02	53 23	68·0	32 39	52 17	67·4	32 15	51 12	66·8	31 51	50 07	66·2	31 27	49 03	65·6	31 02	47 59	65·1	219 321
40 140	33 50	53 00	67·2	33 26	51 53	66·6	33 02	50 48	66·0	32 37	49 43	65·4	32 12	48 38	64·9	31 46	47 34	64·3	220 320
41 139	34 37	52 35	66·5	34 13	51 29	65·9	33 48	50 23	65·3	33 23	49 17	64·7	32 57	48 13	64·1	32 30	47 09	63·5	221 319
42 138	35 25	52 09	65·8	35 00	51 03	65·1	34 34	49 56	64·5	34 08	48 51	63·9	33 42	47 46	63·3	33 14	46 42	62·7	222 318
43 137	36 12	51 43	65·0	35 46	50 36	64·3	35 20	49 29	63·7	34 53	48 24	63·1	34 26	47 19	62·5	33 58	46 15	61·9	223 317
44 136	36 59	51 15	64·2	36 33	50 08	63·6	36 06	49 01	62·9	35 38	47 55	62·3	35 10	46 51	61·6	34 41	45 46	61·0	224 316
45 135	37 46	50 46	63·4	37 19	49 39	62·7	36 51	48 32	62·1	36 22	47 26	61·4	35 53	46 21	60·8	35 24	45 17	60·2	225 315

Lat. / A		30°			31°			32°			33°			34°			35°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	37 46	50 46	63·4	37 19	49 39	62·7	36 51	48 32	62·1	36 22	47 26	61·4	35 53	46 21	60·8	35 24	45 17	60·2	225	315
46	134	38 32	50 16	62·6	38 04	49 08	61·9	37 36	48 02	61·2	37 06	46 56	60·6	36 37	45 51	59·9	36 06	44 46	59·3	226	314
47	133	39 18	49 45	61·8	38 49	48 37	61·1	38 20	47 30	60·4	37 50	46 24	59·7	37 19	45 19	59·1	36 48	44 15	58·4	227	313
48	132	40 04	49 13	61·0	39 34	48 05	60·2	39 04	46 58	59·5	38 33	45 51	58·8	38 02	44 46	58·2	37 30	43 42	57·5	228	312
49	131	40 49	48 39	60·1	40 19	47 31	59·4	39 48	46 24	58·6	39 16	45 18	57·9	38 44	44 12	57·2	38 11	43 08	56·6	229	311
50	130	41 34	48 04	59·2	41 03	46 56	58·5	40 31	45 49	57·7	39 59	44 42	57·0	39 26	43 37	56·3	38 52	42 33	55·6	230	310
51	129	42 18	47 28	58·3	41 46	46 20	57·5	41 14	45 12	56·8	40 41	44 06	56·1	40 07	43 01	55·4	39 32	41 57	54·7	231	309
52	128	43 02	46 50	57·4	42 29	45 42	56·6	41 56	44 34	55·9	41 22	43 28	55·1	40 47	42 23	54·4	40 12	41 19	53·7	232	308
53	127	43 46	46 11	56·4	43 12	45 03	55·6	42 38	43 55	54·9	42 03	42 49	54·1	41 28	41 44	53·4	40 52	40 41	52·7	233	307
54	126	44 29	45 31	55·5	43 54	44 22	54·7	43 19	43 15	53·9	42 44	42 09	53·1	42 07	41 04	52·4	41 30	40 01	51·7	234	306
55	125	45 11	44 49	54·5	44 36	43 40	53·7	44 00	42 33	52·9	43 24	41 27	52·1	42 46	40 23	51·4	42 09	39 19	50·7	235	305
56	124	45 53	44 05	53·5	45 17	42 57	52·6	44 40	41 50	51·8	44 03	40 44	51·1	43 25	39 40	50·3	42 46	38 37	49·6	236	304
57	123	46 35	43 20	52·4	45 58	42 11	51·6	45 20	41 05	50·8	44 42	39 59	50·0	44 03	38 55	49·3	43 24	37 53	48·5	237	303
58	122	47 16	42 33	51·3	46 38	41 25	50·5	45 59	40 18	49·7	45 20	39 13	48·9	44 40	38 09	48·2	44 00	37 07	47·5	238	302
59	121	47 56	41 44	50·2	47 17	40 36	49·4	46 38	39 30	48·6	45 58	38 25	47·8	45 17	37 22	47·1	44 36	36 20	46·3	239	301
60	120	48 35	40 54	49·1	47 56	39 46	48·3	47 16	38 40	47·5	46 35	37 36	46·7	45 53	36 33	45·9	45 11	35 32	45·2	240	300
61	119	49 14	40 01	47·9	48 34	38 54	47·1	47 53	37 48	46·3	47 11	36 45	45·5	46 29	35 42	44·7	45 46	34 42	44·0	241	299
62	118	49 53	39 07	46·8	49 11	38 00	45·9	48 29	36 55	45·1	47 46	35 52	44·3	47 03	34 50	43·6	46 19	33 50	42·8	242	298
63	117	50 30	38 11	45·5	49 48	37 04	44·7	49 05	36 00	43·9	48 21	34 57	43·1	47 37	33 57	42·3	46 53	32 57	41·6	243	297
64	116	51 07	37 13	44·3	50 23	36 07	43·4	49 40	35 03	42·6	48 55	34 01	41·8	48 10	33 01	41·1	47 25	32 03	40·4	244	296
65	115	51 43	36 12	43·0	50 58	35 07	42·2	50 14	34 04	41·3	49 28	33 03	40·6	48 43	32 04	39·8	47 56	31 07	39·1	245	295
66	114	52 18	35 10	41·7	51 33	34 06	40·8	50 47	33 04	40·0	50 01	32 04	39·3	49 14	31 05	38·5	48 27	30 09	37·8	246	294
67	113	52 52	34 05	40·3	52 06	33 02	39·5	51 19	32 01	38·7	50 32	31 02	37·9	49 44	30 05	37·2	48 56	29 10	36·5	247	293
68	112	53 25	32 59	38·9	52 38	31 56	38·1	51 50	30 57	37·3	51 02	29 59	36·6	50 14	29 03	35·8	49 25	28 09	35·2	248	292
69	111	53 57	31 50	37·5	53 09	30 49	36·7	52 21	29 50	35·9	51 32	28 53	35·2	50 43	27 59	34·5	49 53	27 06	33·8	249	291
70	110	54 28	30 39	36·1	53 39	29 39	35·2	52 50	28 42	34·5	52 00	27 46	33·8	51 10	26 53	33·1	50 20	26 02	32·4	250	290
71	109	54 58	29 25	34·6	54 08	28 27	33·8	53 18	27 31	33·0	52 28	26 38	32·3	51 37	25 46	31·6	50 46	24 56	31·0	251	289
72	108	55 27	28 09	33·0	54 37	27 13	32·2	53 46	26 19	31·5	52 54	25 27	30·8	52 03	24 37	30·2	51 10	23 49	29·5	252	288
73	107	55 55	26 51	31·4	55 03	25 57	30·7	54 12	25 04	30·0	53 19	24 14	29·3	52 27	23 26	28·7	51 34	22 40	28·1	253	287
74	106	56 21	25 31	29·8	55 29	24 39	29·1	54 36	23 48	28·4	53 43	23 00	27·8	52 50	22 14	27·1	51 57	21 29	26·6	254	286
75	105	56 46	24 09	28·2	55 53	23 18	27·5	55 00	22 30	26·8	54 06	21 44	26·2	53 12	21 00	25·6	52 18	20 17	25·0	255	285
76	104	57 10	22 44	26·5	56 16	21 56	25·8	55 22	21 10	25·2	54 28	20 26	24·6	53 33	19 44	24·0	52 38	19 04	23·5	256	284
77	103	57 33	21 17	24·8	56 38	20 31	24·1	55 43	19 48	23·5	54 48	19 06	23·0	53 53	18 27	22·4	52 57	17 49	21·9	257	283
78	102	57 54	19 48	23·0	56 59	19 05	22·4	56 03	18 24	21·9	55 07	17 45	21·3	54 11	17 08	20·8	53 15	16 32	20·3	258	282
79	101	58 13	18 17	21·2	57 17	17 37	20·7	56 21	16 59	20·1	55 25	16 22	19·6	54 28	15 48	19·2	53 31	15 15	18·7	259	281
80	100	58 32	16 44	19·4	57 35	16 07	18·9	56 38	15 32	18·4	55 41	14 58	17·9	54 44	14 26	17·5	53 47	13 56	17·1	260	280
81	99	58 48	15 10	17·6	57 51	14 36	17·1	56 53	14 03	16·6	55 56	13 33	16·2	54 58	13 03	15·8	54 00	12 36	15·4	261	279
82	98	59 03	13 33	15·7	58 05	13 02	15·3	57 07	12 33	14·9	56 09	12 06	14·5	55 11	11 40	14·1	54 13	11 14	13·8	262	278
83	97	59 16	11 55	13·8	58 18	11 28	13·4	57 19	11 02	13·0	56 21	10 38	12·7	55 22	10 14	12·4	54 24	9 52	12·1	263	277
84	96	59 28	10 16	11·9	58 29	9 52	11·5	57 30	9 30	11·2	56 31	9 09	10·9	55 32	8 49	10·6	54 33	8 29	10·4	264	276
85	95	59 37	8 35	9·9	58 38	8 15	9·6	57 39	7 56	9·4	56 40	7 39	9·1	55 41	7 22	8·9	54 41	7 06	8·7	265	275
86	94	59 46	6 53	8·0	58 46	6 37	7·7	57 47	6 22	7·5	56 47	6 08	7·3	55 48	5 54	7·1	54 48	5 41	7·0	266	274
87	93	59 52	5 11	6·0	58 52	4 59	5·8	57 52	4 47	5·6	56 53	4 36	5·5	55 53	4 26	5·4	54 53	4 16	5·2	267	273
88	92	59 56	3 28	4·0	58 57	3 19	3·9	57 57	3 12	3·8	56 57	3 05	3·7	55 57	2 58	3·6	54 57	2 51	3·5	268	272
89	91	59 59	1 44	2·0	58 59	1 40	1·9	57 59	1 36	1·9	56 59	1 32	1·8	55 59	1 29	1·8	54 59	1 26	1·7	269	271
90	90	60 00	0 00	0·0	59 00	0 00	0·0	58 00	0 00	0·0	57 00	0 00	0·0	56 00	0 00	0·0	55 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (–) for 90° < LHA < 270°
Dec:(–) for Lat. contrary name

Z_1: same sign as B
Z_2: (–) for LHA > 90°

Lat. / A		36°			37°			38°			39°			40°			41°			Lat. / A	
LHA		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	′	′	°	′	′	°	′	′	°	°	′	°	′	′	°	′	′	°	°	°
0	180	0 00	54 00	90·0	0 00	53 00	90·0	0 00	52 00	90·0	0 00	51 00	90·0	0 00	50 00	90·0	0 00	49 00	90·0	180	360
1	179	0 49	54 00	89·4	0 48	53 00	89·4	0 47	52 00	89·4	0 47	51 00	89·4	0 46	50 00	89·4	0 45	49 00	89·3	181	359
2	178	1 37	53 59	88·8	1 36	52 59	88·8	1 35	51 59	88·8	1 33	50 59	88·7	1 32	49 59	88·7	1 31	48 59	88·7	182	358
3	177	2 26	53 58	88·2	2 24	52 58	88·2	2 22	51 58	88·2	2 20	50 58	88·1	2 18	49 58	88·1	2 16	48 58	88·0	183	357
4	176	3 14	53 56	87·6	3 12	52 56	87·6	3 09	51 56	87·5	3 06	50 56	87·5	3 04	49 56	87·4	3 01	48 56	87·4	184	356
5	175	4 03	53 54	87·1	3 59	52 54	87·0	3 56	51 54	86·9	3 53	50 54	86·8	3 50	49 54	86·8	3 46	48 54	86·7	185	355
6	174	4 51	53 51	86·5	4 47	52 51	86·4	4 43	51 51	86·3	4 40	50 51	86·2	4 36	49 51	86·1	4 31	48 51	86·1	186	354
7	173	5 39	53 48	85·9	5 35	52 48	85·8	5 31	51 48	85·7	5 26	50 47	85·6	5 21	49 47	85·5	5 17	48 47	85·4	187	353
8	172	6 28	53 44	85·3	6 23	52 44	85·2	6 18	51 44	85·1	6 13	50 44	84·9	6 07	49 43	84·8	6 02	48 43	84·7	188	352
9	171	7 16	53 40	84·7	7 11	52 39	84·6	7 05	51 39	84·4	6 59	50 39	84·3	6 53	49 39	84·2	6 47	48 39	84·1	189	351
10	170	8 05	53 35	84·1	7 58	52 35	83·9	7 52	51 34	83·8	7 45	50 34	83·7	7 39	49 34	83·5	7 32	48 34	83·4	190	350
11	169	8 53	53 30	83·5	8 46	52 29	83·3	8 39	51 29	83·2	8 32	50 29	83·0	8 24	49 29	82·9	8 17	48 28	82·7	191	349
12	168	9 41	53 24	82·9	9 33	52 23	82·7	9 26	51 23	82·5	9 18	50 23	82·4	9 10	49 23	82·2	9 02	48 22	82·1	192	348
13	167	10 29	53 17	82·3	10 21	52 17	82·1	10 13	51 17	81·9	10 04	50 16	81·7	9 55	49 16	81·6	9 46	48 16	81·4	193	347
14	166	11 17	53 10	81·7	11 08	52 10	81·5	10 59	51 10	81·3	10 50	50 09	81·1	10 41	49 09	80·9	10 31	48 09	80·7	194	346
15	165	12 05	53 03	81·0	11 56	52 02	80·8	11 46	51 02	80·6	11 36	50 02	80·4	11 26	49 01	80·2	11 16	48 01	80·0	195	345
16	164	12 53	52 55	80·4	12 43	51 54	80·2	12 33	50 54	80·0	12 22	49 53	79·8	12 11	48 53	79·6	12 00	47 53	79·3	196	344
17	163	13 41	52 46	79·8	13 30	51 46	79·6	13 19	50 45	79·3	13 08	49 45	79·1	12 57	48 44	78·9	12 45	47 44	78·7	197	343
18	162	14 29	52 37	79·2	14 17	51 37	78·9	14 06	50 36	78·7	13 54	49 35	78·4	13 42	48 35	78·2	13 29	47 34	78·0	198	342
19	161	15 16	52 28	78·6	15 04	51 27	78·3	14 52	50 26	78·0	14 39	49 25	77·8	14 27	48 25	77·5	14 13	47 24	77·3	199	341
20	160	16 04	52 17	77·9	15 51	51 16	77·6	15 38	50 16	77·4	15 25	49 15	77·1	15 11	48 14	76·8	14 58	47 14	76·6	200	340
21	159	16 51	52 07	77·3	16 38	51 05	77·0	16 24	50 05	76·7	16 10	49 04	76·4	15 56	48 03	76·1	15 42	47 03	75·9	201	339
22	158	17 39	51 55	76·6	17 24	50 54	76·3	17 10	49 53	76·0	16 56	48 52	75·7	16 41	47 51	75·4	16 25	46 51	75·2	202	338
23	157	18 26	51 43	76·0	18 11	50 42	75·7	17 56	49 41	75·4	17 41	48 40	75·0	17 25	47 39	74·7	17 09	46 38	74·4	203	337
24	156	19 13	51 30	75·3	18 57	50 29	75·0	18 42	49 28	74·7	18 26	48 27	74·3	18 09	47 26	74·0	17 53	46 25	73·7	204	336
25	155	20 00	51 17	74·7	19 44	50 15	74·3	19 27	49 14	74·0	19 10	48 13	73·6	18 53	47 12	73·3	18 36	46 12	73·0	205	335
26	154	20 46	51 03	74·0	20 30	50 01	73·6	20 13	49 00	73·3	19 55	47 59	72·9	19 37	46 58	72·6	19 19	45 57	72·3	206	334
27	153	21 33	50 48	73·3	21 15	49 47	73·0	20 58	48 45	72·6	20 40	47 44	72·2	20 21	46 43	71·9	20 02	45 42	71·5	207	333
28	152	22 19	50 33	72·6	22 01	49 31	72·3	21 43	48 30	71·9	21 24	47 28	71·5	21 05	46 28	71·1	20 45	45 27	70·8	208	332
29	151	23 06	50 17	72·0	22 47	49 15	71·6	22 28	48 14	71·2	22 08	47 12	70·8	21 48	46 11	70·4	21 28	45 11	70·0	209	331
30	150	23 52	50 00	71·3	23 32	48 58	70·8	23 12	47 57	70·4	22 52	46 55	70·0	22 31	45 54	69·6	22 10	44 54	69·3	210	330
31	149	24 37	49 43	70·5	24 17	48 41	70·1	23 57	47 39	69·7	23 36	46 38	69·3	23 14	45 37	68·9	22 52	44 36	68·5	211	329
32	148	25 23	49 25	69·8	25 02	48 23	69·4	24 41	47 21	69·0	24 19	46 19	68·5	23 57	45 18	68·1	23 34	44 17	67·7	212	328
33	147	26 09	49 06	69·1	25 47	48 04	68·7	25 25	47 02	68·2	25 02	46 00	67·8	24 40	44 59	67·3	24 16	43 58	66·9	213	327
34	146	26 54	48 46	68·4	26 32	47 44	67·9	26 09	46 42	67·4	25 45	45 40	67·0	25 22	44 39	66·6	24 58	43 39	66·1	214	326
35	145	27 39	48 26	67·6	27 16	47 23	67·1	26 52	46 21	66·7	26 28	45 20	66·2	26 04	44 19	65·8	25 39	43 18	65·3	215	325
36	144	28 24	48 04	66·9	28 00	47 02	66·4	27 36	46 00	65·9	27 11	44 58	65·4	26 46	43 57	65·0	26 20	42 57	64·5	216	324
37	143	29 08	47 42	66·1	28 44	46 40	65·6	28 19	45 38	65·1	27 53	44 36	64·6	27 27	43 35	64·2	27 01	42 34	63·7	217	323
38	142	29 52	47 19	65·3	29 27	46 17	64·8	29 01	45 15	64·3	28 35	44 13	63·8	28 08	43 12	63·3	27 41	42 12	62·9	218	322
39	141	30 36	46 56	64·5	30 10	45 53	64·0	29 44	44 51	63·5	29 17	43 49	63·0	28 49	42 48	62·5	28 21	41 48	62·0	219	321
40	140	31 20	46 31	63·7	30 53	45 28	63·2	30 26	44 26	62·7	29 58	43 25	62·2	29 30	42 24	61·7	29 01	41 23	61·2	220	320
41	139	32 03	46 05	62·9	31 36	45 03	62·4	31 08	44 01	61·8	30 39	42 59	61·3	30 10	41 58	60·8	29 41	40 58	60·3	221	319
42	138	32 46	45 39	62·1	32 18	44 36	61·5	31 49	43 34	61·0	31 20	42 33	60·5	30 50	41 32	59·9	30 20	40 32	59·4	222	318
43	137	33 29	45 11	61·3	33 00	44 09	60·7	32 30	43 07	60·1	32 00	42 05	59·6	31 30	41 05	59·1	30 59	40 04	58·5	223	317
44	136	34 12	44 43	60·4	33 42	43 40	59·8	33 11	42 38	59·3	32 40	41 37	58·7	32 09	40 36	58·2	31 37	39 36	57·6	224	316
45	135	34 54	44 13	59·6	34 23	43 11	59·0	33 52	42 09	58·4	33 20	41 08	57·8	32 48	40 07	57·3	32 15	39 08	56·7	225	315

Lat. / A		36°			37°			38°			39°			40°			41°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	34 54	44 13	59·6	34 23	43 11	59·0	33 52	42 09	58·4	33 20	41 08	57·8	32 48	40 07	57·3	32 15	39 08	56·7	225	315
46	134	35 35	43 43	58·7	35 04	42 40	58·1	34 32	41 38	57·5	33 59	40 37	56·9	33 26	39 37	56·4	32 53	38 38	55·8	226	314
47	133	36 17	43 11	57·8	35 44	42 09	57·2	35 12	41 07	56·6	34 38	40 06	56·0	34 04	39 06	55·4	33 30	38 07	54·9	227	313
48	132	36 57	42 39	56·9	36 24	41 36	56·2	35 51	40 35	55·6	35 17	39 34	55·0	34 42	38 34	54·5	34 07	37 35	53·9	228	312
49	131	37 38	42 05	55·9	37 04	41 03	55·3	36 30	40 01	54·7	35 55	39 01	54·1	35 19	38 01	53·5	34 43	37 03	53·0	229	311
50	130	38 18	41 30	55·0	37 43	40 28	54·4	37 08	39 27	53·7	36 32	38 27	53·1	35 56	37 27	52·5	35 19	36 29	52·0	230	310
51	129	38 57	40 54	54·0	38 22	39 52	53·4	37 46	38 51	52·8	37 09	37 51	52·1	36 32	36 52	51·6	35 55	35 54	51·0	231	309
52	128	39 36	40 17	53·0	39 00	39 15	52·4	38 23	38 14	51·8	37 46	37 15	51·1	37 08	36 16	50·6	36 30	35 18	50·0	232	308
53	127	40 15	39 38	52·0	39 38	38 37	51·4	39 00	37 36	50·8	38 22	36 37	50·1	37 43	35 39	49·5	37 04	34 42	49·0	233	307
54	126	40 53	38 58	51·0	40 15	37 57	50·4	39 36	36 57	49·7	38 57	35 58	49·1	38 18	35 01	48·5	37 38	34 04	47·9	234	306
55	125	41 30	38 17	50·0	40 52	37 17	49·3	40 12	36 17	48·7	39 32	35 19	48·1	38 52	34 21	47·4	38 11	33 25	46·9	235	305
56	124	42 07	37 35	48·9	41 28	36 35	48·3	40 47	35 36	47·6	40 07	34 38	47·0	39 26	33 41	46·4	38 44	32 45	45·8	236	304
57	123	42 44	36 51	47·9	42 03	35 51	47·2	41 22	34 53	46·5	40 41	33 55	45·9	39 59	32 59	45·3	39 16	32 04	44·7	237	303
58	122	43 19	36 06	46·8	42 38	35 07	46·1	41 56	34 09	45·4	41 14	33 12	44·8	40 31	32 16	44·2	39 48	31 22	43·6	238	302
59	121	43 54	35 20	45·6	43 12	34 21	45·0	42 29	33 24	44·3	41 46	32 27	43·7	41 03	31 32	43·1	40 19	30 39	42·5	239	301
60	120	44 29	34 32	44·5	43 46	33 34	43·8	43 02	32 37	43·2	42 18	31 42	42·5	41 34	30 47	41·9	40 49	29 54	41·3	240	300
61	119	45 02	33 43	43·3	44 18	32 45	42·6	43 34	31 49	42·0	42 49	30 55	41·4	42 04	30 01	40·8	41 18	29 09	40·2	241	299
62	118	45 35	32 52	42·1	44 51	31 55	41·5	44 05	31 00	40·8	43 20	30 06	40·2	42 34	29 14	39·6	41 47	28 22	39·0	242	298
63	117	46 07	32 00	40·9	45 22	31 04	40·3	44 36	30 10	39·6	43 49	29 17	39·0	43 03	28 25	38·4	42 15	27 35	37·8	243	297
64	116	46 39	31 06	39·7	45 52	30 11	39·0	45 06	29 18	38·4	44 18	28 26	37·8	43 31	27 35	37·2	42 43	26 46	36·6	244	296
65	115	47 09	30 11	38·4	46 22	29 17	37·8	45 35	28 25	37·1	44 47	27 34	36·5	43 58	26 44	36·0	43 09	25 56	35·4	245	295
66	114	47 39	29 14	37·1	46 51	28 21	36·5	46 03	27 30	35·9	45 14	26 40	35·3	44 25	25 52	34·7	43 35	25 04	34·2	246	294
67	113	48 08	28 16	35·8	47 19	27 24	35·2	46 30	26 34	34·6	45 40	25 45	34·0	44 50	24 58	33·4	44 00	24 12	32·9	247	293
68	112	48 36	27 17	34·5	47 46	26 26	33·9	46 56	25 37	33·3	46 06	24 50	32·7	45 15	24 03	32·2	44 24	23 19	31·6	248	292
69	111	49 03	26 15	33·1	48 13	25 26	32·5	47 22	24 38	31·9	46 31	23 52	31·4	45 39	23 08	30·8	44 48	22 24	30·3	249	291
70	110	49 29	25 13	31·8	48 38	24 25	31·2	47 46	23 39	30·6	46 55	22 54	30·0	46 03	22 11	29·5	45 10	21 29	29·0	250	290
71	109	49 54	24 08	30·4	49 02	23 22	29·8	48 10	22 37	29·2	47 17	21 54	28·7	46 25	21 12	28·2	45 32	20 32	27·7	251	289
72	108	50 18	23 02	28·9	49 25	22 18	28·4	48 33	21 35	27·8	47 39	20 53	27·3	46 46	20 13	26·8	45 52	19 34	26·3	252	288
73	107	50 41	21 55	27·5	49 48	21 12	26·9	48 54	20 31	26·4	48 00	19 51	25·9	47 06	19 13	25·4	46 12	18 35	25·0	253	287
74	106	51 03	20 47	26·0	50 09	20 06	25·5	49 15	19 26	25·0	48 20	18 48	24·5	47 25	18 11	24·0	46 30	17 36	23·6	254	286
75	105	51 24	19 36	24·5	50 29	18 57	24·0	49 34	18 20	23·5	48 39	17 43	23·1	47 44	17 09	22·6	46 48	16 35	22·2	255	285
76	104	51 43	18 25	23·0	50 48	17 48	22·5	49 52	17 12	22·0	48 57	16 38	21·6	48 01	16 05	21·2	47 05	15 33	20·8	256	284
77	103	52 02	17 12	21·4	51 06	16 37	21·0	50 09	16 04	20·6	49 13	15 31	20·1	48 17	15 00	19·8	47 20	14 31	19·4	257	283
78	102	52 19	15 58	19·9	51 22	15 25	19·5	50 25	14 54	19·0	49 29	14 24	18·7	48 32	13 55	18·3	47 35	13 27	18·0	258	282
79	101	52 35	14 43	18·3	51 37	14 13	17·9	50 40	13 43	17·5	49 43	13 16	17·2	48 46	12 49	16·8	47 48	12 23	16·5	259	281
80	100	52 49	13 27	16·7	51 52	12 59	16·3	50 54	12 32	16·0	49 56	12 06	15·7	48 58	11 42	15·3	48 01	11 18	15·0	260	280
81	99	53 02	12 09	15·1	52 04	11 44	14·7	51 06	11 19	14·4	50 08	10 56	14·1	49 10	10 34	13·8	48 12	10 12	13·6	261	279
82	98	53 14	10 51	13·4	52 16	10 28	13·1	51 18	10 06	12·9	50 19	9 45	12·6	49 20	9 25	12·3	48 22	9 06	12·1	262	278
83	97	53 25	9 31	11·8	52 26	9 11	11·5	51 27	8 52	11·3	50 29	8 34	11·0	49 30	8 16	10·8	48 31	7 59	10·6	263	277
84	96	53 34	8 11	10·1	52 35	7 54	9·9	51 36	7 37	9·7	50 37	7 21	9·5	49 38	7 06	9·3	48 38	6 51	9·1	264	276
85	95	53 42	6 50	8·5	52 43	6 36	8·3	51 43	6 22	8·1	50 44	6 09	7·9	49 44	5 56	7·8	48 45	5 44	7·6	265	275
86	94	53 49	5 29	6·8	52 49	5 17	6·6	51 49	5 06	6·5	50 50	4 55	6·3	49 50	4 45	6·2	48 50	4 35	6·1	266	274
87	93	53 54	4 07	5·1	52 54	3 58	5·0	51 54	3 50	4·9	50 54	3 42	4·8	49 54	3 34	4·7	48 55	3 27	4·6	267	273
88	92	53 57	2 45	3·4	52 57	2 39	3·3	51 57	2 33	3·2	50 57	2 28	3·2	49 58	2 23	3·1	48 58	2 18	3·0	268	272
89	91	53 59	1 23	1·7	52 59	1 20	1·7	51 59	1 17	1·6	50 59	1 14	1·6	49 59	1 11	1·6	48 59	1 09	1·5	269	271
90	90	54 00	0 00	0·0	53 00	0 00	0·0	52 00	0 00	0·0	51 00	0 00	0·0	50 00	0 00	0·0	49 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (−) for 90° < LHA < 270°
Dec:(−) for Lat. contrary name

Z_1: same sign as B
Z_2: (−) for F > 90°

Lat. / A	42°			43°			44°			45°			46°			47°			Lat. / A
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° °
0 180	0 00	48 00	90·0	0 00	47 00	90·0	0 00	46 00	90·0	0 00	45 00	90·0	0 00	44 00	90·0	0 00	43 00	90·0	180 360
1 179	0 45	48 00	89·3	0 44	47 00	89·3	0 43	46 00	89·3	0 42	45 00	89·3	0 42	44 00	89·3	0 41	43 00	89·3	181 359
2 178	1 29	47 59	88·7	1 28	46 59	88·6	1 26	45 59	88·6	1 25	44 59	88·6	1 23	43 59	88·6	1 22	42 59	88·5	182 358
3 177	2 14	47 58	88·0	2 12	46 58	88·0	2 09	45 58	87·9	2 07	44 58	87·9	2 05	43 58	87·8	2 03	42 58	87·8	183 357
4 176	2 58	47 56	87·3	2 55	46 56	87·3	2 53	45 56	87·2	2 50	44 56	87·2	2 47	43 56	87·1	2 44	42 56	87·1	184 356
5 175	3 43	47 53	86·6	3 39	46 53	86·6	3 36	45 53	86·5	3 32	44 53	86·5	3 28	43 53	86·4	3 24	42 53	86·3	185 355
6 174	4 27	47 51	86·0	4 23	46 51	85·9	4 19	45 51	85·8	4 14	44 51	85·7	4 10	43 51	85·7	4 05	42 51	85·6	186 354
7 173	5 12	47 47	85·3	5 07	46 47	85·2	5 02	45 47	85·1	4 57	44 47	85·0	4 51	43 47	85·0	4 46	42 47	84·9	187 353
8 172	5 56	47 43	84·6	5 51	46 43	84·5	5 45	45 43	84·4	5 39	44 43	84·3	5 33	43 43	84·2	5 27	42 43	84·1	188 352
9 171	6 41	47 39	84·0	6 34	46 39	83·8	6 28	45 39	83·7	6 21	44 39	83·6	6 14	43 39	83·5	6 07	42 39	83·4	189 351
10 170	7 25	47 34	83·3	7 18	46 34	83·1	7 11	45 34	83·0	7 03	44 34	82·9	6 56	43 34	82·8	6 48	42 34	82·7	190 350
11 169	8 09	47 28	82·6	8 01	46 28	82·4	7 53	45 28	82·3	7 45	44 28	82·2	7 37	43 28	82·0	7 29	42 28	81·9	191 349
12 168	8 53	47 22	81·9	8 45	46 22	81·8	8 36	45 22	81·6	8 27	44 22	81·5	8 18	43 22	81·3	8 09	42 22	81·2	192 348
13 167	9 37	47 16	81·2	9 28	46 15	81·1	9 19	45 15	80·9	9 09	44 15	80·7	8 59	43 15	80·6	8 49	42 16	80·4	193 347
14 166	10 21	47 08	80·5	10 11	46 08	80·3	10 01	45 08	80·2	9 51	44 08	80·0	9 40	43 08	79·8	9 30	42 08	79·7	194 346
15 165	11 05	47 01	79·8	10 55	46 00	79·6	10 44	45 00	79·5	10 33	44 00	79·3	10 21	43 00	79·1	10 10	42 01	78·9	195 345
16 164	11 49	46 52	79·1	11 38	45 52	78·9	11 26	44 52	78·7	11 14	43 52	78·5	11 02	42 52	78·3	10 50	41 52	78·2	196 344
17 163	12 33	46 43	78·4	12 21	45 43	78·2	12 08	44 43	78·0	11 56	43 43	77·8	11 43	42 43	77·6	11 30	41 44	77·4	197 343
18 162	13 17	46 34	77·7	13 04	45 34	77·5	12 51	44 34	77·3	12 37	43 34	77·1	12 24	42 34	76·8	12 10	41 34	76·6	198 342
19 161	14 00	46 24	77·0	13 46	45 24	76·8	13 33	44 24	76·5	13 19	43 24	76·3	13 04	42 24	76·1	12 50	41 24	75·9	199 341
20 160	14 43	46 13	76·3	14 29	45 13	76·1	14 15	44 13	75·8	14 00	43 13	75·6	13 45	42 13	75·3	13 29	41 14	75·1	200 340
21 159	15 27	46 02	75·6	15 12	45 02	75·3	14 56	44 02	75·1	14 41	43 02	74·8	14 25	42 02	74·6	14 09	41 03	74·3	201 339
22 158	16 10	45 50	74·9	15 54	44 50	74·6	15 38	43 50	74·3	15 22	42 50	74·1	15 05	41 50	73·8	14 48	40 51	73·5	202 338
23 157	16 53	45 38	74·1	16 36	44 38	73·9	16 19	43 38	73·6	16 02	42 38	73·3	15 45	41 38	73·0	15 27	40 39	72·8	203 337
24 156	17 36	45 25	73·4	17 18	44 25	73·1	17 01	43 25	72·8	16 43	42 25	72·5	16 25	41 25	72·2	16 06	40 26	72·0	204 336
25 155	18 18	45 11	72·7	18 00	44 11	72·4	17 42	43 11	72·1	17 23	42 11	71·8	17 04	41 12	71·5	16 45	40 12	71·2	205 335
26 154	19 01	44 57	71·9	18 42	43 57	71·6	18 23	42 57	71·3	18 03	41 57	71·0	17 44	40 57	70·7	17 24	39 58	70·4	206 334
27 153	19 43	44 42	71·2	19 24	43 42	70·8	19 04	42 42	70·5	18 43	41 42	70·2	18 23	40 43	69·9	18 02	39 43	69·6	207 333
28 152	20 25	44 26	70·4	20 05	43 26	70·1	19 44	42 26	69·7	19 23	41 27	69·4	19 02	40 27	69·1	18 40	39 28	68·8	208 332
29 151	21 07	44 10	69·6	20 46	43 10	69·3	20 25	42 10	68·9	20 03	41 10	68·6	19 41	40 11	68·3	19 18	39 12	67·9	209 331
30 150	21 49	43 53	68·9	21 27	42 53	68·5	21 05	41 53	68·1	20 42	40 54	67·8	20 19	39 54	67·4	19 56	38 55	67·1	210 330
31 149	22 30	43 35	68·1	22 08	42 35	67·7	21 45	41 36	67·3	21 21	40 36	67·0	20 58	39 37	66·6	20 34	38 38	66·3	211 329
32 148	23 11	43 17	67·3	22 48	42 17	66·9	22 24	41 17	66·5	22 00	40 18	66·2	21 36	39 19	65·8	21 11	38 20	65·4	212 328
33 147	23 53	42 58	66·5	23 28	41 58	66·1	23 04	40 58	65·7	22 39	39 59	65·3	22 14	39 00	65·0	21 48	38 02	64·6	213 327
34 146	24 33	42 38	65·7	24 08	41 38	65·3	23 43	40 39	64·9	23 17	39 40	64·5	22 51	38 41	64·1	22 25	37 42	63·7	214 326
35 145	25 14	42 18	64·9	24 48	41 18	64·5	24 22	40 18	64·1	23 56	39 19	63·7	23 29	38 21	63·3	23 02	37 23	62·9	215 325
36 144	25 54	41 56	64·1	25 28	40 57	63·6	25 01	39 57	63·2	24 34	38 58	62·8	24 06	38 00	62·4	23 38	37 02	62·0	216 324
37 143	26 34	41 34	63·2	26 07	40 35	62·8	25 39	39 35	62·4	25 11	38 37	61·9	24 43	37 38	61·5	24 14	36 41	61·1	217 323
38 142	27 14	41 11	62·4	26 46	40 12	61·9	26 17	39 13	61·5	25 48	38 14	61·1	25 19	37 16	60·7	24 50	36 19	60·3	218 322
39 141	27 53	40 48	61·5	27 24	39 48	61·1	26 55	38 50	60·6	26 25	37 51	60·2	25 55	36 53	59·8	25 25	35 56	59·4	219 321
40 140	28 32	40 23	60·7	28 02	39 24	60·2	27 32	38 25	59·8	27 02	37 27	59·3	26 31	36 30	58·9	26 00	35 32	58·5	220 320
41 139	29 11	39 58	59·8	28 40	38 59	59·3	28 10	38 01	58·9	27 38	37 03	58·4	27 07	36 05	58·0	26 35	35 08	57·6	221 319
42 138	29 49	39 32	58·9	29 18	38 33	58·4	28 46	37 35	58·0	28 14	36 37	57·5	27 42	35 40	57·1	27 09	34 43	56·6	222 318
43 137	30 27	39 05	58·0	29 55	38 06	57·5	29 23	37 08	57·1	28 50	36 11	56·6	28 17	35 14	56·1	27 43	34 18	55·7	223 317
44 136	31 05	38 37	57·1	30 32	37 39	56·6	29 59	36 41	56·1	29 25	35 44	55·7	28 51	34 47	55·2	28 17	33 51	54·8	224 316
45 135	31 42	38 09	56·2	31 08	37 10	55·7	30 34	36 13	55·2	30 00	35 16	54·7	29 25	34 20	54·3	28 50	33 24	53·8	225 315

Lat. / A		42°			43°			44°			45°			46°			47°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	31 42	38 09	56·2	31 08	37 10	55·7	30 34	36 13	55·2	30 00	35 16	54·7	29 25	34 20	54·3	28 50	33 24	53·8	225	315
46	134	32 19	37 39	55·3	31 45	36 41	54·8	31 10	35 44	54·3	30 34	34 47	53·8	29 59	33 51	53·3	29 23	32 56	52·9	226	314
47	133	32 55	37 08	54·3	32 20	36 11	53·8	31 45	35 14	53·3	31 08	34 18	52·8	30 32	33 22	52·4	29 55	32 27	51·9	227	313
48	132	33 31	36 37	53·4	32 55	35 40	52·9	32 19	34 43	52·3	31 42	33 47	51·9	31 05	32 52	51·4	30 27	31 58	50·9	228	312
49	131	34 07	36 05	52·4	33 30	35 08	51·9	32 53	34 11	51·4	32 15	33 16	50·9	31 37	32 21	50·4	30 59	31 27	49·9	229	311
50	130	34 42	35 31	51·4	34 04	34 35	50·9	33 26	33 39	50·4	32 48	32 44	49·9	32 09	31 50	49·4	31 30	30 56	48·9	230	310
51	129	35 17	34 57	50·4	34 38	34 01	49·9	33 59	33 05	49·4	33 20	32 11	48·9	32 40	31 17	48·4	32 00	30 24	47·9	231	309
52	128	35 51	34 22	49·4	35 12	33 26	48·9	34 32	32 31	48·4	33 52	31 37	47·9	33 11	30 44	47·4	32 30	29 52	46·9	232	308
53	127	36 24	33 45	48·4	35 44	32 50	47·9	35 04	31 56	47·3	34 23	31 02	46·8	33 42	30 10	46·3	33 00	29 18	45·9	233	307
54	126	36 57	33 08	47·4	36 17	32 13	46·8	35 35	31 20	46·3	34 54	30 27	45·8	34 12	29 35	45·3	33 29	28 44	44·8	234	306
55	125	37 30	32 30	46·3	36 48	31 36	45·8	36 06	30 43	45·2	35 24	29 50	44·7	34 41	28 59	44·2	33 58	28 08	43·8	235	305
56	124	38 02	31 51	45·2	37 19	30 57	44·7	36 37	30 04	44·2	35 53	29 13	43·6	35 10	28 22	43·2	34 26	27 32	42·7	236	304
57	123	38 33	31 10	44·1	37 50	30 17	43·6	37 06	29 25	43·1	36 22	28 34	42·6	35 38	27 45	42·1	34 53	26 56	41·6	237	303
58	122	39 04	30 29	43·0	38 20	29 36	42·5	37 36	28 45	42·0	36 51	27 55	41·5	36 06	27 06	41·0	35 20	26 18	40·5	238	302
59	121	39 34	29 46	41·9	38 49	28 55	41·4	38 04	28 04	40·9	37 19	27 15	40·4	36 33	26 27	39·9	35 46	25 39	39·4	239	301
60	120	40 04	29 03	40·8	39 18	28 12	40·2	38 32	27 22	39·7	37 46	26 34	39·2	36 59	25 46	38·8	36 12	25 00	38·3	240	300
61	119	40 32	28 18	39·6	39 46	27 28	39·1	38 59	26 39	38·6	38 12	25 52	38·1	37 25	25 05	37·6	36 37	24 20	37·2	241	299
62	118	41 00	27 32	38·5	40 13	26 43	37·9	39 26	25 56	37·4	38 38	25 09	36·9	37 50	24 23	36·5	37 02	23 39	36·0	242	298
63	117	41 28	26 45	37·3	40 40	25 58	36·8	39 52	25 11	36·3	39 03	24 25	35·8	38 14	23 40	35·3	37 25	22 57	34·9	243	297
64	116	41 54	25 58	36·1	41 06	25 11	35·6	40 17	24 25	35·1	39 28	23 40	34·6	38 38	22 57	34·1	37 48	22 14	33·7	244	296
65	115	42 20	25 09	34·9	41 31	24 23	34·4	40 41	23 38	33·9	39 51	22 55	33·4	39 01	22 12	33·0	38 11	21 31	32·5	245	295
66	114	42 45	24 19	33·6	41 55	23 34	33·1	41 05	22 50	32·7	40 14	22 08	32·2	39 23	21 27	31·8	38 32	20 46	31·3	246	294
67	113	43 10	23 28	32·4	42 19	22 44	31·9	41 28	22 02	31·4	40 37	21 21	31·0	39 45	20 40	30·5	38 53	20 01	30·1	247	293
68	112	43 33	22 35	31·1	42 42	21 53	30·6	41 50	21 12	30·2	40 58	20 32	29·7	40 06	19 53	29·3	39 13	19 15	28·9	248	292
69	111	43 56	21 42	29·8	43 04	21 01	29·4	42 11	20 22	28·9	41 19	19 43	28·5	40 26	19 05	28·1	39 33	18 29	27·7	249	291
70	110	44 18	20 48	28·5	43 25	20 08	28·1	42 32	19 30	27·7	41 38	18 53	27·2	40 45	18 17	26·8	39 51	17 41	26·5	250	290
71	109	44 38	19 53	27·2	43 45	19 15	26·8	42 51	18 38	26·4	41 57	18 02	26·0	41 03	17 27	25·6	40 09	16 53	25·2	251	289
72	108	44 58	18 57	25·9	44 04	18 20	25·5	43 10	17 45	25·1	42 16	17 10	24·7	41 21	16 37	24·3	40 26	16 05	24·0	252	288
73	107	45 17	17 59	24·6	44 23	17 24	24·1	43 28	16 51	23·8	42 33	16 18	23·4	41 38	15 46	23·0	40 42	15 15	22·7	253	287
74	106	45 35	17 01	23·2	44 40	16 28	22·8	43 45	15 56	22·4	42 49	15 25	22·1	41 54	14 54	21·7	40 58	14 25	21·4	254	286
75	105	45 53	16 02	21·8	44 57	15 31	21·4	44 01	15 00	21·1	43 05	14 31	20·8	42 09	14 02	20·4	41 12	13 34	20·1	255	285
76	104	46 09	15 02	20·4	45 12	14 33	20·1	44 16	14 04	19·7	43 19	13 36	19·4	42 23	13 09	19·1	41 26	12 43	18·8	256	284
77	103	46 24	14 02	19·0	45 27	13 34	18·7	44 30	13 07	18·4	43 33	12 41	18·1	42 36	12 15	17·8	41 39	11 51	17·5	257	283
78	102	46 38	13 00	17·6	45 40	12 34	17·3	44 43	12 09	17·0	43 46	11 45	16·7	42 48	11 21	16·5	41 51	10 58	16·2	258	282
79	101	46 51	11 58	16·2	45 53	11 34	15·9	44 55	11 11	15·6	43 57	10 48	15·4	43 00	10 26	15·1	42 02	10 05	14·9	259	281
80	100	47 03	10 55	14·8	46 04	10 33	14·5	45 06	10 12	14·2	44 08	9 51	14·0	43 10	9 31	13·8	42 12	9 12	13·6	260	280
81	99	47 13	9 51	13·3	46 15	9 31	13·1	45 16	9 12	12·8	44 18	8 53	12·6	43 19	8 35	12·4	42 21	8 18	12·2	261	279
82	98	47 23	8 47	11·9	46 24	8 29	11·6	45 26	8 12	11·4	44 27	7 55	11·2	43 28	7 39	11·1	42 29	7 24	10·9	262	278
83	97	47 32	7 42	10·4	46 33	7 27	10·2	45 34	7 12	10·0	44 34	6 57	9·9	43 35	6 43	9·7	42 36	6 29	9·5	263	277
84	96	47 39	6 37	8·9	46 40	6 24	8·8	45 41	6 11	8·6	44 41	5 58	8·5	43 42	5 46	8·3	42 42	5 34	8·2	264	276
85	95	47 46	5 32	7·4	46 46	5 20	7·3	45 46	5 09	7·2	44 47	4 59	7·1	43 47	4 49	6·9	42 48	4 39	6·8	265	275
86	94	47 51	4 26	6·0	46 51	4 17	5·9	45 51	4 08	5·7	44 52	3 59	5·6	43 52	3 51	5·6	42 52	3 43	5·5	266	274
87	93	47 55	3 20	4·5	46 55	3 13	4·4	45 55	3 06	4·3	44 55	3 00	4·2	43 55	2 54	4·2	42 56	2 48	4·1	267	273
88	92	47 58	2 13	3·0	46 58	2 09	2·9	45 58	2 04	2·9	44 58	2 00	2·8	43 58	1 56	2·8	42 58	1 52	2·7	268	272
89	91	47 59	1 07	1·5	46 59	1 04	1·5	45 59	1 02	1·4	44 59	1 00	1·4	43 59	0 58	1·4	43 00	0 56	1·4	269	271
90	90	48 00	0 00	0·0	47 00	0 00	0·0	46 00	0 00	0·0	45 00	0 00	0·0	44 00	0 00	0·0	43 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (−) for 90° < LHA < 270°
Dec: (−) for Lat. contrary name

Z_1: same sign as B
Z_2: (−) for LHA > 90

Lat. / A		48°			49°			50°			51°			52°			53°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
0	180	0 00	42 00	90·0	0 00	41 00	90·0	0 00	40 00	90·0	0 00	39 00	90·0	0 00	38 00	90·0	0 00	37 00	90·0	180	360
1	179	0 40	42 00	89·3	0 39	41 00	89·2	0 39	40 00	89·2	0 38	39 00	89·2	0 37	38 00	89·2	0 36	37 00	89·2	181	359
2	178	1 20	41 59	88·5	1 19	40 59	88·5	1 17	39 59	88·5	1 16	38 59	88·4	1 14	37 59	88·4	1 12	36 59	88·4	182	358
3	177	2 00	41 58	87·8	1 58	40 58	87·7	1 56	39 58	87·7	1 53	38 58	87·7	1 51	37 58	87·6	1 48	36 58	87·6	183	357
4	176	2 41	41 56	87·0	2 37	40 56	87·0	2 34	39 56	86·9	2 31	38 56	86·9	2 28	37 56	86·8	2 24	36 56	86·8	184	356
5	175	3 21	41 53	86·3	3 17	40 54	86·2	3 13	39 54	86·2	3 09	38 54	86·1	3 05	37 54	86·1	3 00	36 54	86·0	185	355
6	174	4 01	41 51	85·5	3 56	40 51	85·5	3 51	39 51	85·4	3 46	38 51	85·3	3 41	37 51	85·3	3 36	36 51	85·2	186	354
7	173	4 41	41 47	84·8	4 35	40 47	84·7	4 30	39 47	84·6	4 24	38 47	84·5	4 18	37 48	84·5	4 12	36 48	84·4	187	353
8	172	5 21	41 43	84·0	5 14	40 43	83·9	5 08	39 43	83·9	5 01	38 44	83·8	4 55	37 44	83·7	4 48	36 44	83·6	188	352
9	171	6 01	41 39	83·3	5 53	40 39	83·2	5 46	39 39	83·1	5 39	38 39	83·0	5 32	37 39	82·9	5 24	36 40	82·8	189	351
10	170	6 40	41 34	82·5	6 32	40 34	82·4	6 25	39 34	82·3	6 16	38 34	82·2	6 08	37 35	82·1	6 00	36 35	82·0	190	350
11	169	7 20	41 28	81·8	7 11	40 28	81·7	7 03	39 29	81·5	6 54	38 29	81·4	6 45	37 29	81·3	6 36	36 29	81·2	191	349
12	168	8 00	41 22	81·0	7 50	40 22	80·9	7 41	39 23	80·8	7 31	38 23	80·6	7 21	37 23	80·5	7 11	36 24	80·4	192	348
13	167	8 39	41 16	80·3	8 29	40 16	80·1	8 19	39 16	80·0	8 08	38 16	79·8	7 58	37 17	79·7	7 47	36 17	79·6	193	347
14	166	9 19	41 09	79·5	9 08	40 09	79·3	8 57	39 09	79·2	8 45	38 09	79·0	8 34	37 10	78·9	8 22	36 10	78·7	194	346
15	165	9 58	41 01	78·7	9 47	40 01	78·6	9 35	39 02	78·4	9 22	38 02	78·2	9 10	37 02	78·1	8 58	36 03	77·9	195	345
16	164	10 38	40 53	78·0	10 25	39 53	77·8	10 12	38 53	77·6	9 59	37 54	77·4	9 46	36 54	77·3	9 33	35 55	77·1	196	344
17	163	11 17	40 44	77·2	11 04	39 44	77·0	10 50	38 45	76·8	10 36	37 45	76·6	10 22	36 46	76·5	10 08	35 47	76·3	197	343
18	162	11 56	40 34	76·4	11 42	39 35	76·2	11 27	38 35	76·0	11 13	37 36	75·8	10 58	36 37	75·6	10 43	35 38	75·5	198	342
19	161	12 35	40 25	75·6	12 20	39 25	75·4	12 05	38 26	75·2	11 49	37 26	75·0	11 34	36 27	74·8	11 18	35 28	74·6	199	341
20	160	13 14	40 14	74·9	12 58	39 15	74·6	12 42	38 15	74·4	12 26	37 16	74·2	12 09	36 17	74·0	11 53	35 18	73·8	200	340
21	159	13 52	40 03	74·1	13 36	39 04	73·8	13 19	38 04	73·6	13 02	37 05	73·4	12 45	36 06	73·2	12 27	35 08	73·0	201	339
22	158	14 31	39 51	73·3	14 14	38 52	73·0	13 56	37 53	72·8	13 38	36 54	72·6	13 20	35 55	72·3	13 02	34 56	72·1	202	338
23	157	15 09	39 39	72·5	14 51	38 40	72·2	14 33	37 41	72·0	14 14	36 42	71·7	13 55	35 43	71·5	13 36	34 45	71·3	203	337
24	156	15 48	39 26	71·7	15 29	38 27	71·4	15 09	37 28	71·2	14 50	36 30	70·9	14 30	35 31	70·7	14 10	34 33	70·4	204	336
25	155	16 26	39 13	70·9	16 06	38 14	70·6	15 46	37 15	70·3	15 25	36 17	70·1	15 05	35 18	69·8	14 44	34 20	69·6	205	335
26	154	17 03	38 59	70·1	16 43	38 00	69·8	16 22	37 01	69·5	16 01	36 03	69·2	15 39	35 05	69·0	15 18	34 07	68·7	206	334
27	153	17 41	38 44	69·3	17 20	37 46	69·0	16 58	36 47	68·7	16 36	35 49	68·4	16 14	34 51	68·1	15 51	33 53	67·9	207	333
28	152	18 19	38 29	68·4	17 56	37 30	68·1	17 34	36 32	67·8	17 11	35 34	67·5	16 48	34 36	67·3	16 25	33 38	67·0	208	332
29	151	18 56	38 13	67·6	18 33	37 15	67·3	18 09	36 16	67·0	17 46	35 18	66·7	17 22	34 21	66·4	16 58	33 23	66·1	209	331
30	150	19 33	37 57	66·8	19 09	36 58	66·5	18 45	36 00	66·1	18 20	35 03	65·8	17 56	34 05	65·5	17 31	33 08	65·2	210	330
31	149	20 10	37 40	65·9	19 45	36 41	65·6	19 20	35 44	65·3	18 55	34 46	65·0	18 29	33 49	64·7	18 03	32 52	64·4	211	329
32	148	20 46	37 22	65·1	20 21	36 24	64·8	19 55	35 26	64·4	19 29	34 29	64·1	19 02	33 32	63·8	18 36	32 35	63·5	212	328
33	147	21 22	37 03	64·2	20 56	36 06	63·9	20 30	35 08	63·6	20 03	34 11	63·2	19 35	33 14	62·9	19 08	32 18	62·6	213	327
34	146	21 58	36 44	63·4	21 31	35 47	63·0	21 04	34 49	62·7	20 36	33 53	62·3	20 08	32 56	62·0	19 40	32 00	61·7	214	326
35	145	22 34	36 25	62·5	22 06	35 27	62·1	21 38	34 30	61·8	21 10	33 33	61·4	20 41	32 37	61·1	20 12	31 41	60·8	215	325
36	144	23 10	36 04	61·6	22 41	35 07	61·3	22 12	34 10	60·9	21 43	33 14	60·5	21 13	32 18	60·2	20 43	31 22	59·9	216	324
37	143	23 45	35 43	60·8	23 15	34 46	60·4	22 45	33 50	60·0	22 15	32 53	59·6	21 45	31 58	59·3	21 14	31 02	59·0	217	323
38	142	24 20	35 21	59·9	23 49	34 25	59·5	23 19	33 28	59·1	22 48	32 33	58·7	22 16	31 37	58·4	21 45	30 42	58·0	218	322
39	141	24 54	34 59	59·0	24 23	34 02	58·6	23 52	33 07	58·2	23 20	32 11	57·8	22 48	31 16	57·5	22 15	30 21	57·1	219	321
40	140	25 28	34 36	58·1	24 57	33 40	57·7	24 24	32 44	57·3	23 52	31 49	56·9	23 19	30 54	56·5	22 45	30 00	56·2	220	320
41	139	26 02	34 12	57·1	25 30	33 16	56·7	24 57	32 21	56·3	24 23	31 26	56·0	23 49	30 32	55·6	23 15	29 38	55·2	221	319
42	138	26 36	33 47	56·2	26 02	32 52	55·8	25 28	31 57	55·4	24 54	31 02	55·0	24 20	30 08	54·6	23 45	29 15	54·3	222	318
43	137	27 09	33 22	55·3	26 35	32 27	54·9	26 00	31 32	54·5	25 25	30 38	54·1	24 50	29 45	53·7	24 14	28 52	53·3	223	317
44	136	27 42	32 56	54·3	27 07	32 01	53·9	26 31	31 07	53·5	25 55	30 13	53·1	25 19	29 20	52·7	24 43	28 28	52·4	224	316
45	135	28 14	32 29	53·4	27 38	31 35	53·0	27 02	30 41	52·5	26 25	29 48	52·1	25 48	28 55	51·8	25 11	28 03	51·4	225	315

Lat. / A		48°			49°			50°			51°			52°			53°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	28 14	32 29	53·4	27 38	31 35	53·0	27 02	30 41	52·5	26 25	29 48	52·1	25 48	28 55	51·8	25 11	28 03	51·4	225	315
46	134	28 46	32 01	52·4	28 10	31 08	52·0	27 32	30 14	51·6	26 55	29 22	51·2	26 17	28 29	50·8	25 39	27 38	50·4	226	314
47	133	29 18	31 33	51·4	28 40	30 40	51·0	28 02	29 47	50·6	27 24	28 55	50·2	26 46	28 03	49·8	26 07	27 12	49·4	227	313
48	132	29 49	31 04	50·5	29 11	30 11	50·0	28 32	29 19	49·6	27 53	28 27	49·2	27 14	27 36	48·8	26 34	26 46	48·4	228	312
49	131	30 20	30 34	49·5	29 41	29 42	49·0	29 01	28 50	48·6	28 21	27 59	48·2	27 41	27 08	47·8	27 01	26 18	47·4	229	311
50	130	30 50	30 04	48·5	30 10	29 12	48·0	29 30	28 20	47·6	28 49	27 30	47·2	28 08	26 40	46·8	27 27	25 51	46·4	230	310
51	129	31 20	29 32	47·5	30 39	28 41	47·0	29 58	27 50	46·6	29 17	27 00	46·2	28 35	26 11	45·8	27 53	25 22	45·4	231	309
52	128	31 49	29 00	46·4	31 08	28 09	46·0	30 26	27 19	45·6	29 44	26 30	45·2	29 01	25 41	44·8	28 19	24 53	44·4	232	308
53	127	32 18	28 27	45·4	31 36	27 37	45·0	30 53	26 48	44·5	30 10	25 59	44·1	29 27	25 11	43·7	28 44	24 24	43·3	233	307
54	126	32 46	27 53	44·4	32 03	27 04	43·9	31 20	26 15	43·5	30 36	25 27	43·1	29 52	24 40	42·7	29 08	23 53	42·3	234	306
55	125	33 14	27 19	43·3	32 30	26 30	42·9	31 46	25 42	42·4	31 02	24 55	42·0	30 17	24 08	41·6	29 32	23 23	41·2	235	305
56	124	33 42	26 44	42·2	32 57	25 55	41·8	32 12	25 08	41·4	31 27	24 22	41·0	30 41	23 36	40·6	29 56	22 51	40·2	236	304
57	123	34 08	26 07	41·1	33 23	25 20	40·7	32 37	24 34	40·3	31 51	23 48	39·9	31 05	23 03	39·5	30 19	22 19	39·1	237	303
58	122	34 34	25 30	40·1	33 48	24 44	39·6	33 02	23 58	39·2	32 15	23 14	38·8	31 28	22 29	38·4	30 41	21 46	38·0	238	302
59	121	35 00	24 53	39·0	34 13	24 07	38·5	33 26	23 22	38·1	32 39	22 38	37·7	31 51	21 55	37·3	31 03	21 13	37·0	239	301
60	120	35 25	24 14	37·8	34 37	23 30	37·4	33 50	22 46	37·0	33 02	22 03	36·6	32 13	21 20	36·2	31 25	20 39	35·9	240	300
61	119	35 49	23 35	36·7	35 01	22 51	36·3	34 12	22 08	35·9	33 24	21 26	35·5	32 35	20 45	35·1	31 46	20 04	34·8	241	299
62	118	36 13	22 55	35·6	35 24	22 12	35·2	34 35	21 30	34·8	33 45	20 49	34·4	32 56	20 09	34·0	32 06	19 29	33·7	242	298
63	117	36 36	22 14	34·4	35 46	21 32	34·0	34 56	20 51	33·6	34 06	20 11	33·3	33 16	19 32	32·9	32 26	18 53	32·5	243	297
64	116	36 58	21 32	33·3	36 08	20 52	32·9	35 17	20 12	32·5	34 27	19 33	32·1	33 36	18 54	31·8	32 45	18 17	31·4	244	296
65	115	37 20	20 50	32·1	36 29	20 10	31·7	35 38	19 32	31·3	34 47	18 54	31·0	33 55	18 16	30·6	33 03	17 40	30·3	245	295
66	114	37 41	20 07	30·9	36 49	19 28	30·5	35 58	18 51	30·2	35 06	18 14	29·8	34 13	17 38	29·5	33 21	17 02	29·1	246	294
67	113	38 01	19 23	29·7	37 09	18 46	29·4	36 17	18 09	29·0	35 24	17 33	28·6	34 31	16 59	28·3	33 38	16 24	28·0	247	293
68	112	38 21	18 38	28·5	37 28	18 02	28·2	36 35	17 27	27·8	35 42	16 53	27·5	34 48	16 19	27·1	33 55	15 46	26·8	248	292
69	111	38 40	17 53	27·3	37 46	17 18	27·0	36 53	16 44	26·6	35 59	16 11	26·3	35 05	15 38	26·0	34 11	15 07	25·7	249	291
70	110	38 58	17 07	26·1	38 04	16 33	25·7	37 10	16 01	25·4	36 15	15 29	25·1	35 21	14 58	24·8	34 26	14 27	24·5	250	290
71	109	39 15	16 20	24·9	38 20	15 48	24·5	37 26	15 17	24·2	36 31	14 46	23·9	35 36	14 16	23·6	34 41	13 47	23·3	251	289
72	108	39 31	15 33	23·6	38 36	15 02	23·3	37 41	14 32	23·0	36 46	14 03	22·7	35 50	13 34	22·4	34 55	13 07	22·1	252	288
73	107	39 47	14 45	22·4	38 51	14 16	22·1	37 56	13 47	21·8	37 00	13 19	21·5	36 04	12 52	21·2	35 08	12 25	20·9	253	287
74	106	40 02	13 56	21·1	39 06	13 28	20·8	38 10	13 01	20·5	37 13	12 35	20·3	36 17	12 09	20·0	35 21	11 44	19·8	254	286
75	105	40 16	13 07	19·8	39 19	12 41	19·5	38 23	12 15	19·3	37 26	11 50	19·0	36 29	11 26	18·8	35 33	11 02	18·5	255	285
76	104	40 29	12 17	18·5	39 32	11 53	18·3	38 35	11 28	18·0	37 38	11 05	17·8	36 41	10 42	17·6	35 44	10 20	17·3	256	284
77	103	40 41	11 27	17·3	39 44	11 04	17·0	38 47	10 41	16·8	37 49	10 19	16·5	36 52	9 58	16·3	35 54	9 37	16·1	257	283
78	102	40 53	10 36	16·0	39 55	10 15	15·7	38 57	9 54	15·5	38 00	9 33	15·3	37 02	9 14	15·1	36 04	8 54	14·9	258	282
79	101	41 04	9 45	14·7	40 05	9 25	14·4	39 07	9 06	14·2	38 09	8 47	14·0	37 11	8 29	13·9	36 13	8 11	13·7	259	281
80	100	41 13	8 53	13·3	40 15	8 35	13·2	39 16	8 17	13·0	38 18	8 00	12·8	37 19	7 44	12·6	36 21	7 27	12·5	260	280
81	99	41 22	8 01	12·0	40 23	7 45	11·9	39 25	7 29	11·7	38 26	7 13	11·5	37 27	6 58	11·4	36 28	6 43	11·2	261	279
82	98	41 30	7 09	10·7	40 31	6 54	10·5	39 32	6 40	10·4	38 33	6 26	10·3	37 34	6 12	10·1	36 35	5 59	10·0	262	278
83	97	41 37	6 16	9·4	40 38	6 03	9·2	39 39	5 50	9·1	38 39	5 38	9·0	37 40	5 26	8·9	36 41	5 15	8·7	263	277
84	96	41 43	5 23	8·1	40 44	5 12	7·9	39 44	5 01	7·8	38 45	4 50	7·7	37 45	4 40	7·6	36 46	4 30	7·5	264	276
85	95	41 48	4 29	6·7	40 49	4 20	6·6	39 49	4 11	6·5	38 49	4 02	6·4	37 50	3 54	6·3	36 50	3 45	6·3	265	275
86	94	41 52	3 36	5·4	40 53	3 28	5·3	39 53	3 21	5·2	38 53	3 14	5·1	37 53	3 07	5·1	36 54	3 01	5·0	266	274
87	93	41 56	2 42	4·0	40 56	2 36	4·0	39 56	2 31	3·9	38 56	2 26	3·9	37 56	2 20	3·8	36 56	2 16	3·8	267	273
88	92	41 58	1 48	2·7	40 58	1 44	2·6	39 58	1 41	2·6	38 58	1 37	2·6	37 58	1 34	2·5	36 58	1 30	2·5	268	272
89	91	42 00	0 54	1·3	41 00	0 52	1·3	40 00	0 50	1·3	39 00	0 49	1·3	38 00	0 47	1·3	37 00	0 45	1·3	269	271
90	90	42 00	0 00	0·0	41 00	0 00	0·0	40 00	0 00	0·0	39 00	0 00	0·0	38 00	0 00	0·0	37 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

B: (–) for 90° < LHA < 270°
Dec:(–) for Lat. contrary name

SIGHT REDUCTION TABLE

Z_1: same sign as B
Z_2: (–) for F > 90°

Lat. / A	54°			55°			56°			57°			58°			59°			Lat. / A
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	′	′	°	° ′	° ′	°	° °
0 180	0 00	36 00	90·0	0 00	35 00	90·0	0 00	34 00	90·0	0 00	33 00	90·0	0 00	32 00	90·0	0 00	31 00	90·0	180 360
1 179	0 35	36 00	89·2	0 34	35 00	89·2	0 34	34 00	89·2	0 33	33 00	89·2	0 32	32 00	89·2	0 31	31 00	89·1	181 359
2 178	1 11	35 59	88·4	1 09	34 59	88·4	1 07	33 59	88·3	1 05	32 59	88·3	1 04	31 59	88·3	1 02	30 59	88·3	182 358
3 177	1 46	35 58	87·6	1 43	34 58	87·5	1 41	33 58	87·5	1 38	32 58	87·5	1 35	31 58	87·5	1 33	30 58	87·4	183 357
4 176	2 21	35 56	86·8	2 18	34 56	86·7	2 14	33 56	86·7	2 11	32 56	86·6	2 07	31 56	86·6	2 04	30 56	86·6	184 356
5 175	2 56	35 54	86·0	2 52	34 54	85·9	2 48	33 54	85·9	2 43	32 54	85·8	2 39	31 54	85·8	2 34	30 54	85·7	185 355
6 174	3 31	35 51	85·1	3 26	34 51	85·1	3 21	33 51	85·0	3 16	32 51	85·0	3 11	31 52	84·9	3 05	30 52	84·9	186 354
7 173	4 06	35 48	84·3	4 00	34 48	84·3	3 54	33 48	84·2	3 48	32 48	84·1	3 42	31 48	84·1	3 36	30 49	84·0	187 353
8 172	4 42	35 44	83·5	4 35	34 44	83·4	4 28	33 44	83·4	4 21	32 45	83·3	4 14	31 45	83·2	4 07	30 45	83·1	188 352
9 171	5 17	35 40	82·7	5 09	34 40	82·6	5 01	33 40	82·5	4 53	32 41	82·4	4 45	31 41	82·3	4 37	30 41	82·3	189 351
10 170	5 51	35 35	81·9	5 43	34 35	81·8	5 34	33 36	81·7	5 26	32 36	81·6	5 17	31 36	81·5	5 08	30 37	81·4	190 350
11 169	6 26	35 30	81·1	6 17	34 30	81·0	6 08	33 31	80·8	5 58	32 31	80·7	5 48	31 31	80·6	5 38	30 32	80·5	191 349
12 168	7 01	35 24	80·2	6 51	34 24	80·1	6 41	33 25	80·0	6 30	32 25	79·9	6 20	31 26	79·8	6 09	30 27	79·7	192 348
13 167	7 36	35 18	79·4	7 25	34 18	79·3	7 14	33 19	79·2	7 02	32 19	79·0	6 51	31 20	78·9	6 39	30 21	78·8	193 347
14 166	8 11	35 11	78·6	7 59	34 12	78·5	7 46	33 12	78·3	7 34	32 13	78·2	7 22	31 14	78·1	7 09	30 15	77·9	194 346
15 165	8 45	35 04	77·8	8 32	34 04	77·6	8 19	33 05	77·5	8 06	32 06	77·3	7 53	31 07	77·2	7 40	30 08	77·1	195 345
16 164	9 19	34 56	76·9	9 06	33 57	76·8	8 52	32 58	76·6	8 38	31 58	76·5	8 24	31 00	76·3	8 10	30 01	76·2	196 344
17 163	9 54	34 47	76·1	9 39	33 48	75·9	9 25	32 49	75·8	9 10	31 50	75·6	8 55	30 52	75·5	8 40	29 53	75·3	197 343
18 162	10 28	34 39	75·3	10 13	33 40	75·1	9 57	32 41	74·9	9 41	31 42	74·8	9 25	30 43	74·6	9 09	29 45	74·4	198 342
19 161	11 02	34 29	74·4	10 46	33 30	74·2	10 29	32 32	74·1	10 13	31 33	73·9	9 56	30 35	73·7	9 39	29 36	73·6	199 341
20 160	11 36	34 19	73·6	11 19	33 21	73·4	11 02	32 22	73·2	10 44	31 24	73·0	10 27	30 25	72·8	10 09	29 27	72·7	200 340
21 159	12 10	34 09	72·7	11 52	33 10	72·5	11 34	32 12	72·3	11 15	31 14	72·2	10 57	30 15	72·0	10 38	29 17	71·8	201 339
22 158	12 43	33 58	71·9	12 24	33 00	71·7	12 06	32 01	71·5	11 46	31 03	71·3	11 27	30 05	71·1	11 07	29 07	70·9	202 338
23 157	13 17	33 46	71·0	12 57	32 48	70·8	12 37	31 50	70·6	12 17	30 52	70·4	11 57	29 54	70·2	11 37	28 57	70·0	203 337
24 156	13 50	33 34	70·2	13 29	32 36	70·0	13 09	31 38	69·7	12 48	30 41	69·5	12 27	29 43	69·3	12 06	28 46	69·1	204 336
25 155	14 23	33 22	69·3	14 02	32 24	69·1	13 40	31 26	68·9	13 18	30 29	68·6	12 56	29 31	68·4	12 34	28 34	68·2	205 335
26 154	14 56	33 09	68·5	14 34	32 11	68·2	14 11	31 14	68·0	13 49	30 16	67·8	13 26	29 19	67·5	13 03	28 22	67·3	206 334
27 153	15 29	32 55	67·6	15 06	31 58	67·3	14 42	31 00	67·1	14 19	30 03	66·9	13 55	29 06	66·6	13 31	28 10	66·4	207 333
28 152	16 01	32 41	66·7	15 37	31 44	66·5	15 13	30 47	66·2	14 49	29 50	66·0	14 24	28 53	65·7	14 00	27 57	65·5	208 332
29 151	16 33	32 26	65·8	16 09	31 29	65·6	15 44	30 32	65·3	15 19	29 36	65·1	14 53	28 39	64·8	14 28	27 43	64·6	209 331
30 150	17 05	32 11	65·0	16 40	31 14	64·7	16 14	30 17	64·4	15 48	29 21	64·2	15 22	28 25	63·9	14 55	27 29	63·7	210 330
31 149	17 37	31 55	64·1	17 11	30 58	63·8	16 44	30 02	63·5	16 17	29 06	63·3	15 50	28 10	63·0	15 23	27 15	62·7	211 329
32 148	18 09	31 38	63·2	17 42	30 42	62·9	17 14	29 46	62·6	16 47	28 51	62·3	16 19	27 55	62·1	15 50	27 00	61·8	212 328
33 147	18 40	31 21	62·3	18 12	30 25	62·0	17 44	29 30	61·7	17 15	28 34	61·4	16 47	27 39	61·2	16 17	26 45	60·9	213 327
34 146	19 11	31 04	61·4	18 42	30 08	61·1	18 13	29 13	60·8	17 44	28 18	60·5	17 14	27 23	60·2	16 44	26 29	60·0	214 326
35 145	19 42	30 46	60·5	19 12	29 50	60·2	18 42	28 55	59·9	18 12	28 01	59·6	17 42	27 06	59·3	17 11	26 12	59·0	215 325
36 144	20 13	30 27	59·6	19 42	29 32	59·2	19 11	28 37	58·9	18 40	27 43	58·6	18 09	26 49	58·4	17 37	25 55	58·1	216 324
37 143	20 43	30 07	58·6	20 12	29 13	58·3	19 40	28 19	58·0	19 08	27 25	57·7	18 36	26 31	57·4	18 03	25 38	57·1	217 323
38 142	21 13	29 48	57·7	20 41	28 53	57·4	20 08	27 59	57·1	19 35	27 06	56·8	19 02	26 13	56·5	18 29	25 20	56·2	218 322
39 141	21 43	29 27	56·8	21 10	28 33	56·4	20 36	27 40	56·1	20 03	26 47	55·8	19 29	25 54	55·5	18 55	25 02	55·2	219 321
40 140	22 12	29 06	55·8	21 38	28 13	55·5	21 04	27 20	55·2	20 30	26 27	54·9	19 55	25 35	54·6	19 20	24 43	54·3	220 320
41 139	22 41	28 44	54·9	22 06	27 51	54·5	21 31	26 59	54·2	20 56	26 07	53·9	20 21	25 15	53·6	19 45	24 24	53·3	221 319
42 138	23 10	28 22	53·9	22 34	27 29	53·6	21 58	26 37	53·3	21 22	25 46	52·9	20 46	24 55	52·6	20 10	24 04	52·3	222 318
43 137	23 38	27 59	53·0	23 02	27 07	52·6	22 25	26 15	52·3	21 48	25 24	52·0	21 11	24 34	51·7	20 34	23 43	51·4	223 317
44 136	24 06	27 36	52·0	23 29	26 44	51·7	22 51	25 53	51·3	22 14	25 02	51·0	21 36	24 12	50·7	20 58	23 23	50·4	224 316
45 135	24 34	27 11	51·0	23 56	26 20	50·7	23 17	25 30	50·3	22 39	24 40	50·0	22 00	23 50	49·7	21 21	23 01	49·4	225 315

Lat. / A		54°			55°			56°			57°			58°			59°			Lat. / A	
LHA	F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	24 34	27 11	51·0	23 56	26 20	50·7	23 17	25 30	50·3	22 39	24 40	50·0	22 00	23 50	49·7	21 21	23 01	49·4	225	315
46	134	25 01	26 47	50·0	24 22	25 56	49·7	23 43	25 06	49·4	23 04	24 17	49·0	22 24	23 28	48·7	21 45	22 39	48·4	226	314
47	133	25 28	26 22	49·1	24 48	25 32	48·7	24 08	24 42	48·4	23 28	23 53	48·0	22 48	23 05	47·7	22 08	22 17	47·4	227	313
48	132	25 54	25 56	48·1	25 14	25 06	47·7	24 33	24 17	47·4	23 53	23 29	47·0	23 11	22 41	46·7	22 30	21 54	46·4	228	312
49	131	26 20	25 29	47·1	25 39	24 40	46·7	24 58	23 52	46·4	24 16	23 05	46·0	23 34	22 17	45·7	22 52	21 31	45·4	229	311
50	130	26 46	25 02	46·0	26 04	24 14	45·7	25 22	23 26	45·3	24 40	22 39	45·0	23 57	21 53	44·7	23 14	21 07	44·4	230	310
51	129	27 11	24 34	45·0	26 28	23 47	44·7	25 45	23 00	44·3	25 02	22 14	44·0	24 19	21 28	43·7	23 36	20 43	43·4	231	309
52	128	27 36	24 06	44·0	26 52	23 19	43·6	26 09	22 33	43·3	25 25	21 48	43·0	24 41	21 03	42·7	23 57	20 18	42·3	232	308
53	127	28 00	23 37	43·0	27 16	22 51	42·6	26 32	22 06	42·3	25 47	21 21	41·9	25 02	20 37	41·6	24 17	19 53	41·3	233	307
54	126	28 24	23 07	41·9	27 39	22 22	41·6	26 54	21 38	41·2	26 09	20 54	40·9	25 23	20 10	40·6	24 37	19 27	40·3	234	306
55	125	28 47	22 37	40·9	28 01	21 53	40·5	27 16	21 09	40·2	26 30	20 26	39·9	25 44	19 43	39·5	24 57	19 01	39·2	235	305
56	124	29 10	22 07	39·8	28 24	21 23	39·5	27 37	20 40	39·1	26 50	19 57	38·8	26 04	19 16	38·5	25 17	18 34	38·2	236	304
57	123	29 32	21 35	38·8	28 45	20 52	38·4	27 58	20 10	38·1	27 11	19 29	37·8	26 23	18 48	37·4	25 35	18 07	37·1	237	303
58	122	29 54	21 03	37·7	29 06	20 21	37·3	28 19	19 40	37·0	27 31	18 59	36·7	26 42	18 19	36·4	25 54	17 40	36·1	238	302
59	121	30 15	20 31	36·6	29 27	19 50	36·3	28 38	19 09	35·9	27 50	18 30	35·6	27 01	17 50	35·3	26 12	17 12	35·0	239	301
60	120	30 36	19 58	35·5	29 47	19 18	35·2	28 58	18 38	34·9	28 09	17 59	34·5	27 19	17 21	34·2	26 29	16 43	34·0	240	300
61	119	30 56	19 24	34·4	30 07	18 45	34·1	29 17	18 06	33·8	28 27	17 29	33·5	27 37	16 51	33·2	26 46	16 14	32·9	241	299
62	118	31 16	18 50	33·3	30 26	18 12	33·0	29 35	17 34	32·7	28 45	16 57	32·4	27 54	16 21	32·1	27 03	15 45	31·8	242	298
63	117	31 35	18 15	32·2	30 44	17 38	31·9	29 53	17 02	31·6	29 02	16 26	31·3	28 10	15 50	31·0	27 19	15 15	30·7	243	297
64	116	31 53	17 40	31·1	31 02	17 04	30·8	30 10	16 28	30·5	29 19	15 53	30·2	28 27	15 19	29·9	27 35	14 45	29·6	244	296
65	115	32 11	17 04	30·0	31 19	16 29	29·7	30 27	15 55	29·4	29 35	15 21	29·1	28 42	14 48	28·8	27 50	14 15	28·5	245	295
66	114	32 29	16 28	28·8	31 36	15 54	28·5	30 43	15 20	28·2	29 50	14 48	28·0	28 57	14 16	27·7	28 04	13 44	27·4	246	294
67	113	32 45	15 51	27·7	31 52	15 18	27·4	30 59	14 46	27·1	30 05	14 14	26·8	29 12	13 43	26·6	28 18	13 13	26·3	247	293
68	112	33 01	15 14	26·5	32 08	14 42	26·3	31 14	14 11	26·0	30 20	13 40	25·7	29 26	13 10	25·5	28 31	12 41	25·2	248	292
69	111	33 17	14 36	25·4	32 23	14 05	25·1	31 28	13 35	24·8	30 34	13 06	24·6	29 39	12 37	24·4	28 44	12 09	24·1	249	291
70	110	33 32	13 57	24·2	32 37	13 28	24·0	31 42	12 59	23·7	30 47	12 31	23·5	29 52	12 04	23·2	28 57	11 37	23·0	250	290
71	109	33 46	13 18	23·1	32 51	12 51	22·8	31 55	12 23	22·6	31 00	11 56	22·3	30 04	11 30	22·1	29 09	11 04	21·9	251	289
72	108	33 59	12 39	21·9	33 04	12 13	21·6	32 08	11 46	21·4	31 12	11 21	21·2	30 16	10 56	21·0	29 20	10 31	20·8	252	288
73	107	34 12	12 00	20·7	33 16	11 34	20·5	32 20	11 09	20·2	31 23	10 45	20·0	30 27	10 21	19·8	29 30	9 58	19·6	253	287
74	106	34 24	11 19	19·5	33 28	10 55	19·3	32 31	10 32	19·1	31 34	10 09	18·9	30 37	9 46	18·7	29 41	9 24	18·5	254	286
75	105	34 36	10 39	18·3	33 39	10 16	18·1	32 42	9 54	17·9	31 44	9 32	17·7	30 47	9 11	17·5	29 50	8 50	17·4	255	285
76	104	34 46	9 58	17·1	33 49	9 37	16·9	32 52	9 16	16·7	31 54	8 56	16·6	30 57	8 36	16·4	29 59	8 16	16·2	256	284
77	103	34 56	9 17	15·9	33 59	8 57	15·7	33 01	8 38	15·6	32 03	8 19	15·4	31 05	8 00	15·2	30 07	7 42	15·1	257	283
78	102	35 06	8 35	14·7	34 08	8 17	14·5	33 10	7 59	14·4	32 11	7 41	14·2	31 13	7 24	14·1	30 15	7 07	13·9	258	282
79	101	35 14	7 54	13·5	34 16	7 37	13·3	33 18	7 20	13·2	32 19	7 04	13·0	31 21	6 48	12·9	30 22	6 32	12·8	259	281
80	100	35 22	7 11	12·3	34 24	6 56	12·1	33 25	6 41	12·0	32 26	6 26	11·9	31 27	6 12	11·7	30 29	5 57	11·6	260	280
81	99	35 29	6 29	11·1	34 30	6 15	10·9	33 32	6 01	10·8	32 33	5 48	10·7	31 34	5 35	10·6	30 35	5 22	10·5	261	279
82	98	35 36	5 46	9·9	34 37	5 34	9·7	33 37	5 22	9·6	32 38	5 10	9·5	31 39	4 58	9·4	30 40	4 47	9·3	262	278
83	97	35 41	5 04	8·6	34 42	4 53	8·5	33 43	4 42	8·4	32 43	4 32	8·3	31 44	4 21	8·2	30 45	4 11	8·2	263	277
84	96	35 46	4 21	7·4	34 47	4 11	7·3	33 47	4 02	7·2	32 48	3 53	7·1	31 48	3 44	7·1	30 49	3 36	7·0	264	276
85	95	35 51	3 37	6·2	34 51	3 30	6·1	33 51	3 22	6·0	32 52	3 14	6·0	31 52	3 07	5·9	30 52	3 00	5·8	265	275
86	94	35 54	2 54	4·9	34 54	2 48	4·9	33 54	2 42	4·8	32 55	2 36	4·8	31 55	2 30	4·7	30 55	2 24	4·7	266	274
87	93	35 57	2 11	3·7	34 57	2 06	3·7	33 57	2 01	3·6	32 57	1 57	3·6	31 57	1 52	3·5	30 57	1 48	3·5	267	273
88	92	35 58	1 27	2·5	34 59	1 24	2·4	33 59	1 21	2·4	32 59	1 18	2·4	31 59	1 15	2·4	30 59	1 12	2·3	268	272
89	91	36 00	0 44	1·2	35 00	0 42	1·2	34 00	0 40	1·2	33 00	0 39	1·2	32 00	0 37	1·2	31 00	0 36	1·2	269	271
90	90	36 00	0 00	0·0	35 00	0 00	0·0	34 00	0 00	0·0	33 00	0 00	0·0	32 00	0 00	0·0	31 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (–) for 90° < LHA < 270°
Dec:(–) for Lat. contrary name

Z_1: same sign as B
Z_2: (–) for F > 90°

Lat. / A		60°			61°			62°			63°			64°			65°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
0	180	0 00	30 00	90·0	0 00	29 00	90·0	0 00	28 00	90·0	0 00	27 00	90·0	0 00	26 00	90·0	0 00	25 00	90·0	180	360
1	179	0 30	30 00	89·1	0 29	29 00	89·1	0 28	28 00	89·1	0 27	27 00	89·1	0 26	26 00	89·1	0 25	25 00	89·1	181	359
2	178	1 00	29 59	88·3	0 58	28 59	88·3	0 56	27 59	88·2	0 54	26 59	88·2	0 53	25 59	88·2	0 51	24 59	88·2	182	358
3	177	1 30	29 58	87·4	1 27	28 58	87·4	1 24	27 58	87·4	1 22	26 58	87·3	1 19	25 58	87·3	1 16	24 58	87·3	183	357
4	176	2 00	29 56	86·5	1 56	28 56	86·5	1 53	27 57	86·5	1 49	26 57	86·4	1 45	25 57	86·4	1 41	24 57	86·4	184	356
5	175	2 30	29 54	85·7	2 25	28 54	85·6	2 21	27 55	85·6	2 16	26 55	85·5	2 11	25 55	85·5	2 07	24 55	85·5	185	355
6	174	3 00	29 52	84·8	2 54	28 52	84·7	2 49	27 52	84·7	2 43	26 52	84·6	2 38	25 53	84·6	2 32	24 53	84·6	186	354
7	173	3 30	29 49	83·9	3 23	28 49	83·9	3 17	27 49	83·8	3 10	26 50	83·8	3 04	25 50	83·7	2 57	24 50	83·7	187	353
8	172	3 59	29 45	83·1	3 52	28 46	83·0	3 45	27 46	82·9	3 37	26 46	82·9	3 30	25 47	82·8	3 22	24 47	82·7	188	352
9	171	4 29	29 42	82·2	4 21	28 42	82·1	4 13	27 42	82·0	4 04	26 43	82·0	3 56	25 43	81·9	3 47	24 44	81·8	189	351
10	170	4 59	29 37	81·3	4 50	28 38	81·2	4 41	27 38	81·2	4 31	26 39	81·1	4 22	25 39	81·0	4 13	24 40	80·9	190	350
11	169	5 28	29 33	80·4	5 18	28 33	80·4	5 08	27 34	80·3	4 58	26 34	80·2	4 48	25 35	80·1	4 38	24 36	80·0	191	349
12	168	5 58	29 27	79·6	5 47	28 28	79·5	5 36	27 29	79·4	5 25	26 29	79·3	5 14	25 30	79·2	5 02	24 31	79·1	192	348
13	167	6 27	29 22	78·7	6 16	28 22	78·6	6 04	27 23	78·5	5 52	26 24	78·4	5 40	25 25	78·3	5 27	24 26	78·2	193	347
14	166	6 57	29 15	77·8	6 44	28 16	77·7	6 31	27 17	77·6	6 18	26 18	77·5	6 05	25 20	77·4	5 52	24 21	77·3	194	346
15	165	7 26	29 09	76·9	7 13	28 10	76·8	6 59	27 11	76·7	6 45	26 12	76·6	6 31	25 14	76·5	6 17	24 15	76·4	195	345
16	164	7 55	29 02	76·1	7 41	28 03	75·9	7 26	27 04	75·8	7 11	26 06	75·7	6 56	25 07	75·5	6 41	24 09	75·4	196	344
17	163	8 24	28 54	75·2	8 09	27 56	75·0	7 53	26 57	74·9	7 38	25 59	74·8	7 22	25 00	74·6	7 06	24 02	74·5	197	343
18	162	8 53	28 46	74·3	8 37	27 48	74·1	8 20	26 50	74·0	8 04	25 51	73·9	7 47	24 53	73·7	7 30	23 55	73·6	198	342
19	161	9 22	28 38	73·4	9 05	27 40	73·2	8 48	26 41	73·1	8 30	25 43	72·9	8 12	24 45	72·8	7 55	23 48	72·7	199	341
20	160	9 51	28 29	72·5	9 33	27 31	72·3	9 14	26 33	72·2	8 56	25 35	72·0	8 37	24 37	71·9	8 19	23 40	71·7	200	340
21	159	10 19	28 19	71·6	10 00	27 22	71·4	9 41	26 24	71·3	9 22	25 26	71·1	9 02	24 29	71·0	8 43	23 32	70·8	201	339
22	158	10 48	28 10	70·7	10 28	27 12	70·5	10 08	26 15	70·4	9 48	25 17	70·2	9 27	24 20	70·0	9 07	23 23	69·9	202	338
23	157	11 16	27 59	69·8	10 55	27 02	69·6	10 34	26 05	69·5	10 13	25 08	69·3	9 52	24 11	69·1	9 30	23 14	69·0	203	337
24	156	11 44	27 49	68·9	11 22	26 51	68·7	11 00	25 54	68·5	10 38	24 58	68·4	10 16	24 01	68·2	9 54	23 04	68·0	204	336
25	155	12 12	27 37	68·0	11 49	26 40	67·8	11 27	25 44	67·6	11 04	24 47	67·4	10 41	23 51	67·3	10 17	22 55	67·1	205	335
26	154	12 40	27 26	67·1	12 16	26 29	66·9	11 53	25 33	66·7	11 29	24 36	66·5	11 05	23 40	66·3	10 41	22 44	66·2	206	334
27	153	13 07	27 13	66·2	12 43	26 17	66·0	12 18	25 21	65·8	11 54	24 25	65·6	11 29	23 29	65·4	11 04	22 34	65·2	207	333
28	152	13 35	27 01	65·3	13 09	26 05	65·1	12 44	25 09	64·9	12 18	24 13	64·7	11 53	23 18	64·5	11 27	22 23	64·3	208	332
29	151	14 02	26 48	64·4	13 36	25 52	64·1	13 09	24 56	63·9	12 43	24 01	63·7	12 16	23 06	63·5	11 49	22 11	63·3	209	331
30	150	14 29	26 34	63·4	14 02	25 39	63·2	13 35	24 43	63·0	13 07	23 49	62·8	12 40	22 54	62·6	12 12	21 59	62·4	210	330
31	149	14 55	26 20	62·5	14 28	25 25	62·3	14 00	24 30	62·1	13 31	23 36	61·8	13 03	22 41	61·6	12 34	21 47	61·4	211	329
32	148	15 22	26 05	61·6	14 53	25 11	61·3	14 24	24 16	61·1	13 55	23 22	60·9	13 26	22 28	60·7	12 56	21 35	60·5	212	328
33	147	15 48	25 50	60·6	15 19	24 56	60·4	14 49	24 02	60·2	14 19	23 08	59·9	13 49	22 15	59·7	13 18	21 22	59·5	213	327
34	146	16 14	25 35	59·7	15 44	24 41	59·5	15 13	23 47	59·2	14 42	22 54	59·0	14 11	22 01	58·8	13 40	21 08	58·6	214	326
35	145	16 40	25 19	58·8	16 09	24 25	58·5	15 37	23 32	58·3	15 06	22 39	58·0	14 34	21 47	57·8	14 02	20 54	57·6	215	325
36	144	17 05	25 02	57·8	16 33	24 09	57·6	16 01	23 17	57·3	15 29	22 24	57·1	14 56	21 32	56·9	14 23	20 40	56·6	216	324
37	143	17 31	24 45	56·9	16 58	23 53	56·6	16 25	23 00	56·4	15 51	22 09	56·1	15 18	21 17	55·9	14 44	20 26	55·7	217	323
38	142	17 56	24 28	55·9	17 22	23 36	55·7	16 48	22 44	55·4	16 14	21 53	55·2	15 39	21 01	54·9	15 05	20 11	54·7	218	322
39	141	18 20	24 10	55·0	17 46	23 18	54·7	17 11	22 27	54·4	16 36	21 36	54·2	16 01	20 46	54·0	15 25	19 55	53·7	219	321
40	140	18 45	23 52	54·0	18 09	23 00	53·7	17 34	22 10	53·5	16 58	21 19	53·2	16 22	20 29	53·0	15 46	19 39	52·7	220	320
41	139	19 09	23 33	53·0	18 33	22 42	52·8	17 56	21 52	52·5	17 20	21 02	52·2	16 43	20 13	52·0	16 06	19 23	51·8	221	319
42	138	19 33	23 13	52·1	18 56	22 23	51·8	18 19	21 34	51·5	17 41	20 44	51·3	17 03	19 55	51·0	16 26	19 07	50·8	222	318
43	137	19 56	22 54	51·1	19 18	22 04	50·8	18 40	21 15	50·5	18 02	20 26	50·3	17 24	19 38	50·0	16 45	18 50	49·8	223	317
44	136	20 19	22 33	50·1	19 41	21 44	49·8	19 02	20 56	49·5	18 23	20 08	49·3	17 44	19 20	49·0	17 04	18 33	48·8	224	316
45	135	20 42	22 12	49·1	20 03	21 24	48·8	19 23	20 36	48·6	18 43	19 49	48·3	18 03	19 02	48·1	17 23	18 15	47·8	225	315

Lat. / A		60°			61°			62°			63°			64°			65°			Lat. / A	
LHA	/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	20 42	22 12	49·1	20 03	21 24	48·8	19 23	20 36	48·6	18 43	19 49	48·3	18 03	19 02	48·1	17 23	18 15	47·8	225	315
46	134	21 05	21 51	48·1	20 25	21 04	47·8	19 44	20 16	47·6	19 04	19 29	47·3	18 23	18 43	47·1	17 42	17 57	46·8	226	314
47	133	21 27	21 30	47·1	20 46	20 43	46·8	20 05	19 56	46·6	19 24	19 10	46·3	18 42	18 24	46·1	18 00	17 39	45·8	227	313
48	132	21 49	21 07	46·1	21 07	20 21	45·8	20 25	19 35	45·6	19 43	18 50	45·3	19 01	18 04	45·1	18 18	17 20	44·8	228	312
49	131	22 10	20 45	45·1	21 28	19 59	44·8	20 45	19 14	44·6	20 02	18 29	44·3	19 19	17 45	44·0	18 36	17 01	43·8	229	311
50	130	22 31	20 22	44·1	21 48	19 37	43·8	21 05	18 52	43·5	20 21	18 08	43·3	19 37	17 24	43·0	18 53	16 41	42·8	230	310
51	129	22 52	19 58	43·1	22 08	19 14	42·8	21 24	18 30	42·5	20 40	17 47	42·3	19 55	17 04	42·0	19 10	16 21	41·8	231	309
52	128	23 12	19 34	42·1	22 28	18 51	41·8	21 43	18 08	41·5	20 58	17 25	41·2	20 13	16 43	41·0	19 27	16 01	40·8	232	308
53	127	23 32	19 10	41·0	22 47	18 27	40·7	22 01	17 45	40·5	21 15	17 03	40·2	20 30	16 21	40·0	19 44	15 41	39·7	233	307
54	126	23 52	18 45	40·0	23 06	18 03	39·7	22 19	17 21	39·4	21 33	16 40	39·2	20 46	16 00	39·0	20 00	15 20	38·7	234	306
55	125	24 11	18 19	39·0	23 24	17 38	38·7	22 37	16 58	38·4	21 50	16 17	38·2	21 03	15 38	37·9	20 15	14 58	37·7	235	305
56	124	24 29	17 54	37·9	23 42	17 13	37·6	22 54	16 34	37·4	22 07	15 54	37·1	21 19	15 15	36·9	20 31	14 37	36·7	236	304
57	123	24 48	17 27	36·9	23 59	16 48	36·6	23 11	16 09	36·3	22 23	15 31	36·1	21 34	14 53	35·8	20 46	14 15	35·6	237	303
58	122	25 05	17 01	35·8	24 17	16 22	35·5	23 28	15 44	35·3	22 39	15 07	35·0	21 49	14 29	34·8	21 00	13 53	34·6	238	302
59	121	25 23	16 34	34·8	24 33	15 56	34·5	23 44	15 19	34·2	22 54	14 42	34·0	22 04	14 06	33·8	21 14	13 30	33·5	239	301
60	120	25 40	16 06	33·7	24 50	15 29	33·4	23 59	14 53	33·2	23 09	14 18	32·9	22 19	13 42	32·7	21 28	13 07	32·5	240	300
61	119	25 56	15 38	32·6	25 05	15 03	32·4	24 15	14 27	32·1	23 24	13 53	31·9	22 33	13 18	31·7	21 42	12 44	31·5	241	299
62	118	26 12	15 10	31·5	25 21	14 35	31·3	24 29	14 01	31·1	23 38	13 27	30·8	22 46	12 54	30·6	21 55	12 21	30·4	242	298
63	117	26 27	14 41	30·5	25 36	14 08	30·2	24 44	13 34	30·0	23 52	13 01	29·8	22 59	12 29	29·5	22 07	11 57	29·3	243	297
64	116	26 42	14 12	29·4	25 50	13 39	29·1	24 57	13 07	28·9	24 05	12 35	28·7	23 12	12 04	28·5	22 19	11 33	28·3	244	296
65	115	26 57	13 43	28·3	26 04	13 11	28·1	25 11	12 40	27·8	24 18	12 09	27·6	23 25	11 39	27·4	22 31	11 09	27·2	245	295
66	114	27 11	13 13	27·2	26 17	12 42	27·0	25 24	12 12	26·8	24 30	11 43	26·6	23 36	11 13	26·4	22 43	10 44	26·2	246	294
67	113	27 24	12 43	26·1	26 30	12 13	25·9	25 36	11 44	25·7	24 42	11 16	25·5	23 48	10 47	25·3	22 54	10 20	25·1	247	293
68	112	27 37	12 12	25·0	26 43	11 44	24·8	25 48	11 16	24·6	24 54	10 48	24·4	23 59	10 21	24·2	23 04	9 55	24·0	248	292
69	111	27 50	11 41	23·9	26 55	11 14	23·7	26 00	10 47	23·5	25 05	10 21	23·3	24 09	9 55	23·1	23 14	9 29	23·0	249	291
70	110	28 01	11 10	22·8	27 06	10 44	22·6	26 11	10 18	22·4	25 15	9 53	22·2	24 20	9 28	22·0	23 24	9 04	21·9	250	290
71	109	28 13	10 39	21·7	27 17	10 14	21·5	26 21	9 49	21·3	25 25	9 25	21·1	24 29	9 01	21·0	23 33	8 38	20·8	251	289
72	108	28 24	10 07	20·6	27 27	9 43	20·4	26 31	9 20	20·2	25 35	8 57	20·0	24 38	8 34	19·9	23 42	8 12	19·7	252	288
73	107	28 34	9 35	19·4	27 37	9 12	19·3	26 41	8 50	19·1	25 44	8 28	18·9	24 47	8 07	18·8	23 50	7 46	18·6	253	287
74	106	28 44	9 03	18·3	27 47	8 41	18·2	26 50	8 20	18·0	25 52	8 00	17·8	24 55	7 39	17·7	23 58	7 19	17·6	254	286
75	105	28 53	8 30	17·2	27 55	8 10	17·0	26 58	7 50	16·9	26 01	7 31	16·7	25 03	7 12	16·6	24 06	6 53	16·5	255	285
76	104	29 01	7 57	16·1	28 04	7 38	15·9	27 06	7 20	15·8	26 08	7 02	15·6	25 10	6 44	15·5	24 13	6 26	15·4	256	284
77	103	29 09	7 24	14·9	28 11	7 06	14·8	27 13	6 49	14·7	26 15	6 32	14·5	25 17	6 16	14·4	24 19	5 59	14·3	257	283
78	102	29 17	6 51	13·8	28 18	6 34	13·7	27 20	6 19	13·5	26 22	6 03	13·4	25 23	5 47	13·3	24 25	5 32	13·2	258	282
79	101	29 24	6 17	12·7	28 25	6 02	12·5	27 27	5 48	12·4	26 28	5 33	12·3	25 29	5 19	12·2	24 31	5 05	12·1	259	281
80	100	29 30	5 44	11·5	28 31	5 30	11·4	27 32	5 17	11·3	26 33	5 03	11·2	25 35	4 50	11·1	24 36	4 38	11·0	260	280
81	99	29 36	5 10	10·4	28 37	4 57	10·3	27 38	4 45	10·2	26 38	4 33	10·1	25 39	4 22	10·0	24 40	4 10	9·9	261	279
82	98	29 41	4 36	9·2	28 41	4 25	9·1	27 42	4 14	9·0	26 43	4 03	9·0	25 44	3 53	8·9	24 44	3 43	8·8	262	278
83	97	29 45	4 01	8·1	28 46	3 52	8·0	27 46	3 42	7·9	26 47	3 33	7·8	25 48	3 24	7·8	24 48	3 15	7·7	263	277
84	96	29 49	3 27	6·9	28 50	3 19	6·9	27 50	3 11	6·8	26 50	3 03	6·7	25 51	2 55	6·7	24 51	2 47	6·6	264	276
85	95	29 52	2 53	5·8	28 53	2 46	5·7	27 53	2 39	5·7	26 53	2 33	5·6	25 54	2 26	5·6	24 54	2 20	5·5	265	275
86	94	29 55	2 18	4·6	28 55	2 13	4·6	27 56	2 07	4·5	26 56	2 02	4·5	25 56	1 57	4·4	24 56	1 52	4·4	266	274
87	93	29 57	1 44	3·5	28 57	1 40	3·4	27 57	1 36	3·4	26 58	1 32	3·4	25 58	1 28	3·3	24 58	1 24	3·3	267	273
88	92	29 59	1 09	2·3	28 59	1 06	2·3	27 59	1 04	2·3	26 59	1 01	2·2	25 59	0 59	2·2	24 59	0 56	2·2	268	272
89	91	30 00	0 35	1·2	29 00	0 33	1·1	28 00	0 32	1·1	27 00	0 31	1·1	26 00	0 29	1·1	25 00	0 28	1·1	269	271
90	90	30 00	0 00	0·0	29 00	0 00	0·0	28 00	0 00	0·0	27 00	0 00	0·0	26 00	0 00	0·0	25 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (–) for 90° < LHA < 270°
Dec:(–) for Lat. contrary name

Z_1: same sign as B
Z_2: (–) for F > 90°

Lat. / A	66°			67°			68°			69°			70°			71°			Lat. / A
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° °
0 180	0 00	24 00	90·0	0 00	23 00	90·0	0 00	22 00	90·0	0 00	21 00	90·0	0 00	20 00	90·0	0 00	19 00	90·0	180 360
1 179	0 24	24 00	89·1	0 23	23 00	89·1	0 22	22 00	89·1	0 22	21 00	89·1	0 21	20 00	89·1	0 20	19 00	89·1	181 359
2 178	0 49	23 59	88·2	0 47	22 59	88·2	0 45	21 59	88·1	0 43	20 59	88·1	0 41	19 59	88·1	0 39	18 59	88·1	182 358
3 177	1 13	23 58	87·3	1 10	22 58	87·2	1 07	21 58	87·2	1 04	20 58	87·2	1 02	19 58	87·2	0 59	18 59	87·2	183 357
4 176	1 38	23 57	86·3	1 34	22 57	86·3	1 30	21 57	86·3	1 26	20 57	86·3	1 22	19 57	86·2	1 18	18 57	86·2	184 356
5 175	2 02	23 55	85·4	1 57	22 55	85·4	1 52	21 55	85·4	1 47	20 56	85·3	1 42	19 56	85·3	1 38	18 56	85·3	185 355
6 174	2 26	23 53	84·5	2 20	22 53	84·5	2 15	21 53	84·4	2 09	20 54	84·4	2 03	19 54	84·4	1 57	18 54	84·3	186 354
7 173	2 50	23 50	83·6	2 44	22 51	83·6	2 37	21 51	83·5	2 30	20 51	83·5	2 23	19 52	83·4	2 16	18 52	83·4	187 353
8 172	3 15	23 48	82·7	3 07	22 48	82·6	2 59	21 48	82·6	2 52	20 49	82·5	2 44	19 49	82·5	2 36	18 50	82·4	188 352
9 171	3 39	23 44	81·8	3 30	22 45	81·7	3 22	21 45	81·6	3 13	20 46	81·6	3 04	19 46	81·5	2 55	18 47	81·5	189 351
10 170	4 03	23 41	80·8	3 53	22 41	80·8	3 44	21 42	80·7	3 34	20 42	80·7	3 24	19 43	80·6	3 14	18 44	80·5	190 350
11 169	4 27	23 36	79·9	4 17	22 37	79·9	4 06	21 38	79·8	3 55	20 39	79·7	3 45	19 40	79·6	3 34	18 41	79·6	191 349
12 168	4 51	23 32	79·0	4 40	22 33	78·9	4 28	21 34	78·9	4 16	20 35	78·8	4 05	19 36	78·7	3 53	18 37	78·6	192 348
13 167	5 15	23 27	78·1	5 03	22 28	78·0	4 50	21 29	77·9	4 37	20 30	77·8	4 25	19 32	77·8	4 12	18 33	77·7	193 347
14 166	5 39	23 22	77·2	5 25	22 23	77·1	5 12	21 24	77·0	4 58	20 26	76·9	4 45	19 27	76·8	4 31	18 28	76·7	194 346
15 165	6 03	23 16	76·2	5 48	22 18	76·1	5 34	21 19	76·0	5 19	20 21	76·0	5 05	19 22	75·9	4 50	18 24	75·8	195 345
16 164	6 26	23 10	75·3	6 11	22 12	75·2	5 56	21 13	75·1	5 40	20 15	75·0	5 25	19 17	74·9	5 09	18 19	74·8	196 344
17 163	6 50	23 04	74·4	6 34	22 06	74·3	6 17	21 08	74·2	6 01	20 09	74·1	5 44	19 11	74·0	5 28	18 14	73·9	197 343
18 162	7 13	22 57	73·5	6 56	21 59	73·3	6 39	21 01	73·2	6 21	20 03	73·1	6 04	19 06	73·0	5 46	18 08	72·9	198 342
19 161	7 37	22 50	72·5	7 19	21 52	72·4	7 00	20 54	72·3	6 42	19 57	72·2	6 24	18 59	72·1	6 05	18 02	72·0	199 341
20 160	8 00	22 42	71·6	7 41	21 45	71·5	7 22	20 47	71·4	7 02	19 50	71·2	6 43	18 53	71·1	6 24	17 56	71·0	200 340
21 159	8 23	22 34	70·7	8 03	21 37	70·5	7 43	20 40	70·4	7 23	19 43	70·3	7 02	18 46	70·2	6 42	17 49	70·1	201 339
22 158	8 46	22 26	69·7	8 25	21 29	69·6	8 04	20 32	69·5	7 43	19 35	69·3	7 22	18 39	69·2	7 00	17 42	69·1	202 338
23 157	9 09	22 17	68·8	8 47	21 21	68·7	8 25	20 24	68·5	8 03	19 28	68·4	7 41	18 31	68·3	7 19	17 35	68·1	203 337
24 156	9 31	22 08	67·9	9 09	21 12	67·7	8 46	20 16	67·6	8 23	19 19	67·4	8 00	18 24	67·3	7 37	17 28	67·2	204 336
25 155	9 54	21 58	66·9	9 30	21 03	66·8	9 07	20 07	66·6	8 43	19 11	66·5	8 19	18 15	66·3	7 55	17 20	66·2	205 335
26 154	10 16	21 49	66·0	9 52	20 53	65·8	9 27	19 57	65·7	9 02	19 02	65·5	8 37	18 07	65·4	8 12	17 12	65·2	206 334
27 153	10 38	21 38	65·0	10 13	20 43	64·9	9 48	19 48	64·7	9 22	18 53	64·6	8 56	17 58	64·4	8 30	17 03	64·3	207 333
28 152	11 00	21 28	64·1	10 34	20 33	63·9	10 08	19 38	63·8	9 41	18 43	63·6	9 14	17 49	63·5	8 48	16 55	63·3	208 332
29 151	11 22	21 17	63·1	10 55	20 22	63·0	10 28	19 28	62·8	10 00	18 34	62·6	9 33	17 39	62·5	9 05	16 46	62·3	209 331
30 150	11 44	21 05	62·2	11 16	20 11	62·0	10 48	19 17	61·8	10 19	18 23	61·7	9 51	17 30	61·5	9 22	16 36	61·4	210 330
31 149	12 06	20 53	61·2	11 37	20 00	61·1	11 07	19 06	60·9	10 38	18 13	60·7	10 09	17 20	60·5	9 39	16 27	60·4	211 329
32 148	12 27	20 41	60·3	11 57	19 48	60·1	11 27	18 55	59·9	10 57	18 02	59·7	10 27	17 09	59·6	9 56	16 17	59·4	212 328
33 147	12 48	20 29	59·3	12 17	19 36	59·1	11 46	18 43	58·9	11 15	17 51	58·8	10 44	16 58	58·6	10 13	16 06	58·4	213 327
34 146	13 09	20 16	58·4	12 37	19 23	58·2	12 06	18 31	58·0	11 34	17 39	57·8	11 02	16 47	57·6	10 29	15 56	57·5	214 326
35 145	13 29	20 02	57·4	12 57	19 10	57·2	12 24	18 19	57·0	11 52	17 27	56·8	11 19	16 36	56·7	10 46	15 45	56·5	215 325
36 144	13 50	19 49	56·4	13 17	18 57	56·2	12 43	18 06	56·0	12 10	17 15	55·9	11 36	16 24	55·7	11 02	15 34	55·5	216 324
37 143	14 10	19 34	55·5	13 36	18 44	55·3	13 02	17 53	55·1	12 27	17 03	54·9	11 53	16 12	54·7	11 18	15 23	54·5	217 323
38 142	14 30	19 20	54·5	13 55	18 30	54·3	13 20	17 40	54·1	12 45	16 50	53·9	12 09	16 00	53·7	11 34	15 11	53·5	218 322
39 141	14 50	19 05	53·5	14 14	18 15	53·3	13 38	17 26	53·1	13 02	16 37	52·9	12 26	15 48	52·7	11 49	14 59	52·6	219 321
40 140	15 09	18 50	52·5	14 33	18 01	52·3	13 56	17 12	52·1	13 19	16 23	51·9	12 42	15 35	51·7	12 05	14 47	51·6	220 320
41 139	15 29	18 34	51·5	14 51	17 46	51·3	14 14	16 57	51·1	13 36	16 09	50·9	12 58	15 22	50·8	12 20	14 34	50·6	221 319
42 138	15 48	18 18	50·6	15 09	17 30	50·3	14 31	16 43	50·1	13 52	15 55	49·9	13 14	15 08	49·8	12 35	14 21	49·6	222 318
43 137	16 06	18 02	49·6	15 27	17 15	49·4	14 48	16 28	49·2	14 09	15 41	49·0	13 29	14 54	48·8	12 50	14 08	48·6	223 317
44 136	16 25	17 46	48·6	15 45	16 59	48·4	15 05	16 12	48·2	14 25	15 26	48·0	13 45	14 40	47·8	13 04	13 55	47·6	224 316
45 135	16 43	17 29	47·6	16 02	16 42	47·4	15 22	15 57	47·2	14 41	15 11	47·0	14 00	14 26	46·8	13 19	13 41	46·6	225 315

Lat. / A		66°			67°			68°			69°			70°			71°			Lat. / A	
LHA	A/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	16 43	17 29	47·6	16 02	16 42	47·4	15 22	15 57	47·2	14 41	15 11	47·0	14 00	14 26	46·8	13 19	13 41	46·6	225	315
46	134	17 01	17 11	46·6	16 19	16 26	46·4	15 38	15 41	46·2	14 56	14 56	46·0	14 15	14 11	45·8	13 33	13 27	45·6	226	314
47	133	17 18	16 53	45·6	16 36	16 09	45·4	15 54	15 24	45·2	15 12	14 40	45·0	14 29	13 56	44·8	13 46	13 13	44·6	227	313
48	132	17 36	16 35	44·6	16 53	15 51	44·4	16 10	15 08	44·2	15 27	14 24	44·0	14 43	13 41	43·8	14 00	12 58	43·6	228	312
49	131	17 53	16 17	43·6	17 09	15 34	43·4	16 25	14 51	43·2	15 42	14 08	43·0	14 58	13 26	42·8	14 13	12 44	42·6	229	311
50	130	18 09	15 58	42·6	17 25	15 16	42·4	16 41	14 33	42·1	15 56	13 52	41·9	15 11	13 10	41·8	14 27	12 29	41·6	230	310
51	129	18 26	15 39	41·6	17 41	14 57	41·3	16 56	14 16	41·1	16 10	13 35	40·9	15 25	12 54	40·8	14 39	12 14	40·6	231	309
52	128	18 42	15 20	40·5	17 56	14 39	40·3	17 10	13 58	40·1	16 24	13 18	39·9	15 38	12 38	39·7	14 52	11 58	39·6	232	308
53	127	18 57	15 00	39·5	18 11	14 20	39·3	17 24	13 40	39·1	16 38	13 00	38·9	15 51	12 21	38·7	15 04	11 42	38·6	233	307
54	126	19 13	14 40	38·5	18 26	14 01	38·3	17 39	13 22	38·1	16 51	12 43	37·9	16 04	12 05	37·7	15 16	11 26	37·5	234	306
55	125	19 28	14 20	37·5	18 40	13 41	37·3	17 52	13 03	37·1	17 04	12 25	36·9	16 16	11 48	36·7	15 28	11 10	36·5	235	305
56	124	19 42	13 59	36·4	18 54	13 21	36·2	18 06	12 44	36·0	17 17	12 07	35·8	16 28	11 30	35·7	15 40	10 54	35·5	236	304
57	123	19 57	13 38	35·4	19 08	13 01	35·2	18 19	12 25	35·0	17 29	11 49	34·8	16 40	11 13	34·6	15 51	10 37	34·5	237	303
58	122	20 11	13 17	34·4	19 21	12 41	34·2	18 31	12 05	34·0	17 42	11 30	33·8	16 52	10 55	33·6	16 02	10 20	33·5	238	302
59	121	20 24	12 55	33·3	19 34	12 20	33·1	18 44	11 45	32·9	17 53	11 11	32·8	17 03	10 37	32·6	16 12	10 03	32·4	239	301
60	120	20 37	12 33	32·3	19 47	11 59	32·1	18 56	11 25	31·9	18 05	10 52	31·7	17 14	10 19	31·6	16 23	9 46	31·4	240	300
61	119	20 50	12 11	31·2	19 59	11 38	31·1	19 08	11 05	30·9	18 16	10 33	30·7	17 24	10 00	30·5	16 33	9 29	30·4	241	299
62	118	21 03	11 48	30·2	20 11	11 16	30·0	19 19	10 44	29·8	18 27	10 13	29 7	17 35	9 42	29·5	16 42	9 11	29·4	242	298
63	117	21 15	11 26	29·2	20 22	10 54	29·0	19 30	10 24	28·8	18 37	9 53	28·6	17 45	9 23	28·5	16 52	8 53	28·3	243	297
64	116	21 27	11 03	28·1	20 34	10 32	27·9	19 41	10 03	27·7	18 47	9 33	27·6	17 54	9 04	27·4	17 01	8 35	27·3	244	296
65	115	21 38	10 39	27·0	20 44	10 10	26·9	19 51	9 41	26·7	18 57	9 13	26·5	18 03	8 45	26·4	17 10	8 17	26·3	245	295
66	114	21 49	10 16	26·0	20 55	9 48	25·8	20 01	9 20	25·7	19 07	8 52	25·5	18 12	8 25	25·4	17 18	7 58	25·2	246	294
67	113	21 59	9 52	24·9	21 05	9 25	24·8	20 10	8 58	24·6	19 16	8 32	24·5	18 21	8 06	24·3	17 26	7 40	24·2	247	293
68	112	22 09	9 28	23·9	21 14	9 02	23·7	20 19	8 36	23·5	19 24	8 11	23·4	18 29	7 46	23·3	17 34	7 21	23·1	248	292
69	111	22 19	9 04	22·8	21 24	8 39	22·6	20 28	8 14	22·5	19 33	7 50	22·4	18 37	7 26	22·2	17 42	7 02	22·1	249	291
70	110	22 28	8 39	21·7	21 32	8 16	21·6	20 37	7 52	21·4	19 41	7 29	21·3	18 45	7 06	21·2	17 49	6 43	21·1	250	290
71	109	22 37	8 15	20·7	21 41	7 52	20·5	20 45	7 30	20·4	19 48	7 07	20·2	18 52	6 45	20·1	17 56	6 24	20·0	251	289
72	108	22 45	7 50	19·6	21 49	7 28	19·4	20 52	7 07	19·3	19 56	6 46	19·2	18 59	6 25	19·1	18 02	6 04	19·0	252	288
73	107	22 53	7 25	18·5	21 56	7 04	18·4	21 00	6 44	18·2	20 03	6 24	18·1	19 05	6 04	18·0	18 08	5 45	17·9	253	287
74	106	23 01	7 00	17·4	22 04	6 40	17·3	21 06	6 21	17·2	20 09	6 02	17·1	19 12	5 44	17·0	18 14	5 25	16·9	254	286
75	105	23 08	6 34	16·3	22 10	6 16	16·2	21 13	5 58	16·1	20 15	5 40	16·0	19 17	5 23	15·9	18 20	5 06	15·8	255	285
76	104	23 15	6 09	15·3	22 17	5 52	15·2	21 19	5 35	15·1	20 21	5 18	15·0	19 23	5 02	14·9	18 25	4 46	14·8	256	284
77	103	23 21	5 43	14·2	22 23	5 27	14·1	21 24	5 12	14·0	20 26	4 56	13·9	19 28	4 41	13·8	18 30	4 26	13·7	257	283
78	102	23 27	5 17	13·1	22 28	5 03	13·0	21 30	4 48	12·9	20 31	4 34	12·8	19 33	4 20	12·7	18 34	4 06	12·7	258	282
79	101	23 32	4 51	12·0	22 33	4 38	11·9	21 35	4 24	11·8	20 36	4 11	11·8	19 37	3 58	11·7	18 38	3 46	11·6	259	281
80	100	23 37	4 25	10·9	22 38	4 13	10·8	21 39	4 01	10·8	20 40	3 49	10·7	19 41	3 37	10·6	18 42	3 25	10·6	260	280
81	99	23 41	3 59	9·8	22 42	3 48	9·8	21 43	3 37	9·7	20 44	3 26	9·6	19 45	3 16	9·6	18 45	3 05	9·5	261	279
82	98	23 45	3 33	8·7	22 46	3 23	8·7	21 46	3 13	8·6	20 47	3 03	8·6	19 48	2 54	8·5	18 48	2 45	8·5	262	278
83	97	23 49	3 06	7·7	22 49	2 58	7·6	21 50	2 49	7·5	20 50	2 41	7·5	19 51	2 32	7·4	18 51	2 24	7·4	263	277
84	96	23 52	2 40	6·6	22 52	2 32	6·5	21 52	2 25	6·5	20 53	2 18	6·4	19 53	2 11	6·4	18 54	2 04	6·3	264	276
85	95	23 54	2 13	5·5	22 54	2 07	5·4	21 55	2 01	5·4	20 55	1 55	5·4	19 55	1 49	5·3	18 55	1 43	5·3	265	275
86	94	23 56	1 47	4·4	22 56	1 42	4·3	21 57	1 37	4·3	20 57	1 32	4·3	19 57	1 27	4·3	18 57	1 23	4·2	266	274
87	93	23 58	1 20	3·3	22 58	1 16	3·3	21 58	1 13	3·2	20 58	1 09	3·2	19 58	1 05	3·2	18 58	1 02	3·2	267	273
88	92	23 59	0 53	2·2	22 59	0 51	2·2	21 59	0 48	2·2	20 59	0 46	2·1	19 59	0 44	2·1	18 59	0 41	2·1	268	272
89	91	24 00	0 27	1·1	23 00	0 25	1·1	22 00	0 24	1·1	21 00	0 23	1·1	20 00	0 22	1·1	19 00	0 21	1·1	269	271
90	90	24 00	0 00	0·0	23 00	0 00	0·0	22 00	0 00	0·0	21 00	0 00	0·0	20 00	0 00	0·0	19 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (–) for 90° < LHA < 270°
Dec:(–) for Lat. contrary name

Z_1: same sign as B
Z_2: (–) for F > 90°

Lat. / A	72°			73°			74°			75°			76°			77°			Lat. / A
LHA/F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA
° °	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° °
0 180	0 00	18 00	90·0	0 00	17 00	90·0	0 00	16 00	90·0	0 00	15 00	90·0	0 00	14 00	90·0	0 00	13 00	90·0	180 360
1 179	0 19	18 00	89·0	0 18	17 00	89·0	0 17	16 00	89·0	0 16	15 00	89·0	0 15	14 00	89·0	0 13	13 00	89·0	181 359
2 178	0 37	17 59	88·1	0 35	16 59	88·1	0 33	15 59	88·1	0 31	14 59	88·1	0 29	14 00	88·1	0 27	13 00	88·1	182 358
3 177	0 56	17 59	87·1	0 53	16 59	87·1	0 50	15 59	87·1	0 47	14 59	87·1	0 44	13 59	87·1	0 40	12 59	87·1	183 357
4 176	1 14	17 58	86·2	1 10	16 58	86·2	1 06	15 58	86·2	1 02	14 58	86·1	0 58	13 58	86·1	0 54	12 58	86·1	184 356
5 175	1 33	17 56	85·2	1 28	16 56	85·2	1 23	15 57	85·2	1 18	14 57	85·2	1 12	13 57	85·1	1 07	12 57	85·1	185 355
6 174	1 51	17 54	84·3	1 45	16 55	84·3	1 39	15 55	84·2	1 33	14 55	84·2	1 27	13 56	84·2	1 21	12 56	84·2	186 354
7 173	2 09	17 52	83·3	2 03	16 53	83·3	1 56	15 53	83·3	1 48	14 54	83·2	1 41	13 54	83·2	1 34	12 54	83·2	187 353
8 172	2 28	17 50	82·4	2 20	16 51	82·3	2 12	15 51	82·3	2 04	14 52	82·3	1 56	13 52	82·2	1 48	12 53	82·2	188 352
9 171	2 46	17 48	81·4	2 37	16 48	81·4	2 28	15 49	81·3	2 19	14 49	81·3	2 10	13 50	81·3	2 01	12 51	81·2	189 351
10 170	3 05	17 45	80·5	2 55	16 45	80·4	2 45	15 46	80·4	2 35	14 47	80·3	2 24	13 48	80·3	2 14	12 49	80·3	190 350
11 169	3 23	17 41	79·5	3 12	16 42	79·5	3 01	15 43	79·4	2 50	14 44	79·4	2 39	13 45	79·3	2 28	12 46	79·3	191 349
12 168	3 41	17 38	78·6	3 29	16 39	78·5	3 17	15 40	78·5	3 05	14 41	78·4	2 53	13 42	78·3	2 41	12 44	78·3	192 348
13 167	3 59	17 34	77·6	3 46	16 35	77·5	3 33	15 37	77·5	3 20	14 38	77·4	3 07	13 39	77·4	2 54	12 41	77·3	193 347
14 166	4 17	17 30	76·7	4 03	16 31	76·6	3 49	15 33	76·5	3 35	14 34	76·5	3 21	13 36	76·4	3 07	12 38	76·3	194 346
15 165	4 35	17 25	75·7	4 20	16 27	75·6	4 05	15 29	75·6	3 50	14 31	75·5	3 35	13 32	75·4	3 20	12 34	75·4	195 345
16 164	4 53	17 21	74·7	4 37	16 23	74·7	4 21	15 25	74·6	4 05	14 27	74·5	3 49	13 29	74·5	3 33	12 31	74·4	196 344
17 163	5 11	17 16	73·8	4 54	16 18	73·7	4 37	15 20	73·6	4 20	14 22	73·5	4 03	13 25	73·5	3 46	12 27	73·4	197 343
18 162	5 29	17 10	72·8	5 11	16 13	72·7	4 53	15 15	72·7	4 35	14 18	72·6	4 17	13 20	72·5	3 59	12 23	72·4	198 342
19 161	5 46	17 05	71·9	5 28	16 07	71·8	5 09	15 10	71·7	4 50	14 13	71·6	4 31	13 16	71·5	4 12	12 19	71·5	199 341
20 160	6 04	16 59	70·9	5 44	16 02	70·8	5 25	15 05	70·7	5 05	14 08	70·6	4 45	13 11	70·5	4 25	12 14	70·5	200 340
21 159	6 21	16 52	69·9	6 01	15 56	69·8	5 40	14 59	69·7	5 19	14 03	69·7	4 58	13 06	69·6	4 37	12 10	69·5	201 339
22 158	6 39	16 46	69·0	6 17	15 50	68·9	5 56	14 53	68·8	5 34	13 57	68·7	5 12	13 01	68·6	4 50	12 05	68·5	202 338
23 157	6 56	16 39	68·0	6 34	15 43	67·9	6 11	14 47	67·8	5 48	13 51	67·7	5 25	12 56	67·6	5 03	12 00	67·5	203 337
24 156	7 13	16 32	67·1	6 50	15 36	66·9	6 26	14 41	66·8	6 03	13 45	66·7	5 39	12 50	66·6	5 15	11 55	66·5	204 336
25 155	7 30	16 25	66·1	7 06	15 29	66·0	6 41	14 34	65·9	6 17	13 39	65·8	5 52	12 44	65·7	5 27	11 49	65·6	205 335
26 154	7 47	16 17	65·1	7 22	15 22	65·0	6 56	14 27	64·9	6 31	13 32	64·8	6 05	12 38	64·7	5 40	11 43	64·6	206 334
27 153	8 04	16 09	64·1	7 38	15 14	64·0	7 11	14 20	63·9	6 45	13 26	63·8	6 18	12 32	63·7	5 52	11 37	63·6	207 333
28 152	8 20	16 00	63·2	7 53	15 06	63·0	7 26	14 12	62·9	6 59	13 19	62·8	6 31	12 25	62·7	6 04	11 31	62·6	208 332
29 151	8 37	15 52	62·2	8 09	14 58	62·1	7 41	14 05	61·9	7 13	13 11	61·8	6 44	12 18	61·7	6 16	11 25	61·6	209 331
30 150	8 53	15 43	61·2	8 24	14 50	61·1	7 55	13 57	61·0	7 26	13 04	60·9	6 57	12 11	60·7	6 27	11 18	60·6	210 330
31 149	9 09	15 34	60·3	8 40	14 41	60·1	8 10	13 49	60·0	7 40	12 56	59·9	7 09	12 04	59·8	6 39	11 12	59·7	211 329
32 148	9 25	15 24	59·3	8 55	14 32	59·1	8 24	13 40	59·0	7 53	12 48	58·9	7 22	11 56	58·8	6 51	11 05	58·7	212 328
33 147	9 41	15 15	58·3	9 10	14 23	58·2	8 38	13 31	58·0	8 06	12 40	57·9	7 34	11 49	57·8	7 02	10 57	57·7	213 327
34 146	9 57	15 05	57·3	9 25	14 13	57·2	8 52	13 22	57·0	8 19	12 31	56·9	7 46	11 41	56·8	7 14	10 50	56·7	214 326
35 145	10 13	14 54	56·3	9 39	14 04	56·2	9 06	13 13	56·1	8 32	12 23	55·9	7 59	11 33	55·8	7 25	10 43	55·7	215 325
36 144	10 28	14 44	55·4	9 54	13 54	55·2	9 19	13 04	55·1	8 45	12 14	54·9	8 11	11 24	54·8	7 36	10 35	54·7	216 324
37 143	10 43	14 33	54·4	10 08	13 43	54·2	9 33	12 54	54·1	8 58	12 05	53·9	8 22	11 16	53·8	7 47	10 27	53·7	217 323
38 142	10 58	14 22	53·4	10 22	13 33	53·2	9 46	12 44	53·1	9 10	11 55	53·0	8 34	11 07	52·8	7 58	10 19	52·7	218 322
39 141	11 13	14 10	52·4	10 36	13 22	52·2	9 59	12 34	52·1	9 22	11 46	52·0	8 45	10 58	51·8	8 08	10 10	51·7	219 321
40 140	11 27	13 59	51·4	10 50	13 11	51·3	10 12	12 23	51·1	9 35	11 36	51·0	8 57	10 49	50·8	8 19	10 02	50·7	220 320
41 139	11 42	13 47	50·4	11 04	13 00	50·3	10 25	12 13	50·1	9 47	11 26	50·0	9 08	10 39	49·9	8 29	9 53	49·7	221 319
42 138	11 56	13 34	49·4	11 17	12 48	49·3	10 38	12 02	49·1	9 58	11 16	49·0	9 19	10 30	48·9	8 39	9 44	48·7	222 318
43 137	12 10	13 22	48·4	11 30	12 36	48·3	10 50	11 51	48·1	10 10	11 05	48·0	9 30	10 20	47·9	8 49	9 35	47·7	223 317
44 136	12 24	13 09	47·4	11 43	12 24	47·3	11 02	11 39	47·1	10 21	10 55	47·0	9 40	10 10	46·9	8 59	9 26	46·7	224 316
45 135	12 37	12 56	46·4	11 56	12 12	46·3	11 14	11 28	46·1	10 33	10 44	46·0	9 51	10 00	45·9	9 09	9 16	45·7	225 315

Lat. / A		72°			73°			74°			75°			76°			77°			Lat. / A	
LHA	F	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	12 37	12 56	46·4	11 56	12 12	46·3	11 14	11 28	46·1	10 33	10 44	46·0	9 51	10 00	45·9	9 09	9 16	45·7	225	315
46	134	12 51	12 43	45·4	12 08	11 59	45·3	11 26	11 16	45·1	10 44	10 33	45·0	10 01	9 50	44·9	9 19	9 07	44·7	226	314
47	133	13 04	12 30	44·4	12 21	11 47	44·3	11 38	11 04	44·1	10 55	10 21	44·0	10 11	9 39	43·9	9 28	8 57	43·7	227	313
48	132	13 17	12 16	43·4	12 33	11 34	43·3	11 49	10 52	43·1	11 05	10 10	43·0	10 21	9 28	42·9	9 37	8 47	42·7	228	312
49	131	13 29	12 02	42·4	12 45	11 21	42·3	12 00	10 39	42·1	11 16	9 58	42·0	10 31	9 17	41·9	9 46	8 37	41·7	229	311
50	130	13 42	11 48	41·4	12 57	11 07	41·3	12 11	10 27	41·1	11 26	9 46	41·0	10 41	9 06	40·9	9 55	8 26	40·7	230	310
51	129	13 54	11 33	40·4	13 08	10 53	40·3	12 22	10 14	40·1	11 36	9 34	40·0	10 50	8 55	39·8	10 04	8 16	39·7	231	309
52	128	14 06	11 19	39·4	13 19	10 40	39·2	12 33	10 01	39·1	11 46	9 22	39·0	10 59	8 44	38·8	10 13	8 05	38·7	232	308
53	127	14 17	11 04	38·4	13 30	10 26	38·2	12 43	9 47	38·1	11 56	9 10	38·0	11 08	8 32	37·8	10 21	7 55	37·7	233	307
54	126	14 29	10 49	37·4	13 41	10 11	37·2	12 53	9 34	37·1	12 05	8 57	36·9	11 17	8 20	36·8	10 29	7 44	36·7	234	306
55	125	14 40	10 33	36·4	13 51	9 57	36·2	13 03	9 20	36·1	12 14	8 44	35·9	11 26	8 08	35·8	10 37	7 33	35·7	235	305
56	124	14 51	10 18	35·3	14 02	9 42	35·2	13 13	9 07	35·1	12 23	8 31	34·9	11 34	7 56	34·8	10 45	7 21	34·7	236	304
57	123	15 01	10 02	34·3	14 12	9 27	34·2	13 22	8 53	34·0	12 32	8 18	33·9	11 42	7 44	33·8	10 52	7 10	33·7	237	303
58	122	15 12	9 46	33·3	14 21	9 12	33·2	13 31	8 38	33·0	12 41	8 05	32·9	11 50	7 32	32·8	11 00	6 58	32·7	238	302
59	121	15 22	9 30	32·3	14 31	8 57	32·1	13 40	8 24	32·0	12 49	7 51	31·9	11 58	7 19	31·8	11 07	6 47	31·7	239	301
60	120	15 31	9 14	31·3	14 40	8 41	31·1	13 49	8 10	31·0	12 57	7 38	30·9	12 06	7 06	30·8	11 14	6 35	30·6	240	300
61	119	15 41	8 57	30·2	14 49	8 26	30·1	13 57	7 55	30·0	13 05	7 24	29·8	12 13	6 54	29·7	11 21	6 23	29·6	241	299
62	118	15 50	8 40	29·2	14 58	8 10	29·1	14 05	7 40	28·9	13 13	7 10	28·8	12 20	6 41	28·7	11 27	6 11	28·6	242	298
63	117	15 59	8 23	28·2	15 06	7 54	28·0	14 13	7 25	27·9	13 20	6 56	27·8	12 27	6 27	27·7	11 34	5 59	27·6	243	297
64	116	16 08	8 06	27·2	15 14	7 38	27·0	14 21	7 10	26·9	13 27	6 42	26·8	12 34	6 14	26·7	11 40	5 47	26·6	244	296
65	115	16 16	7 49	26·1	15 22	7 22	26·0	14 28	6 55	25·9	13 34	6 28	25·8	12 40	6 01	25·7	11 46	5 34	25·6	245	295
66	114	16 24	7 32	25·1	15 29	7 05	25·0	14 35	6 39	24·9	13 41	6 13	24·7	12 46	5 47	24·6	11 52	5 22	24·6	246	294
67	113	16 32	7 14	24·1	15 37	6 49	23·9	14 42	6 24	23·8	13 47	5 59	23·7	12 52	5 34	23·6	11 57	5 09	23·5	247	293
68	112	16 39	6 56	23·0	15 44	6 32	22·9	14 48	6 08	22·8	13 53	5 44	22·7	12 58	5 20	22·6	12 02	4 57	22·5	248	292
69	111	16 46	6 38	22·0	15 50	6 15	21·9	14 55	5 52	21·8	13 59	5 29	21·7	13 03	5 06	21·6	12 07	4 44	21·5	249	291
70	110	16 53	6 20	20·9	15 57	5 58	20·8	15 01	5 36	20·7	14 05	5 14	20·6	13 08	4 52	20·6	12 12	4 31	20·5	250	290
71	109	16 59	6 02	19·9	16 03	5 41	19·8	15 06	5 20	19·7	14 10	4 59	19·6	13 13	4 38	19·5	12 17	4 18	19·5	251	289
72	108	17 05	5 44	18·9	16 09	5 24	18·8	15 12	5 04	18·7	14 15	4 44	18·6	13 18	4 24	18·5	12 21	4 05	18·4	252	288
73	107	17 11	5 26	17·8	16 14	5 06	17·7	15 17	4 48	17·6	14 20	4 29	17·6	13 23	4 10	17·5	12 25	3 52	17·4	253	287
74	106	17 17	5 07	16·8	16 19	4 49	16·7	15 22	4 31	16·6	14 24	4 13	16·5	13 27	3 56	16·5	12 29	3 38	16·4	254	286
75	105	17 22	4 48	15·7	16 24	4 31	15·7	15 26	4 15	15·6	14 29	3 58	15·5	13 31	3 42	15·4	12 33	3 25	15·4	255	285
76	104	17 27	4 30	14·7	16 29	4 14	14·6	15 31	3 58	14·5	14 33	3 43	14·5	13 35	3 27	14·4	12 36	3 12	14·4	256	284
77	103	17 31	4 11	13·6	16 33	3 56	13·6	15 35	3 41	13·5	14 36	3 27	13·4	13 38	3 13	13·4	12 40	2 58	13·3	257	283
78	102	17 36	3 52	12·6	16 37	3 38	12·5	15 38	3 25	12·5	14 40	3 11	12·4	13 41	2 58	12·4	12 43	2 45	12·3	258	282
79	101	17 39	3 33	11·6	16 41	3 20	11·5	15 42	3 08	11·4	14 43	2 56	11·4	13 44	2 43	11·3	12 45	2 31	11·3	259	281
80	100	17 43	3 14	10·5	16 44	3 02	10·4	15 45	2 51	10·4	14 46	2 40	10·3	13 47	2 29	10·3	12 48	2 18	10·3	260	280
81	99	17 46	2 55	9·5	16 47	2 44	9·4	15 48	2 34	9·4	14 49	2 24	9·3	13 49	2 14	9·3	12 50	2 04	9·2	261	279
82	98	17 49	2 35	8·4	16 50	2 26	8·4	15 50	2 17	8·3	14 51	2 08	8·3	13 52	1 59	8·2	12 52	1 50	8·2	262	278
83	97	17 52	2 16	7·4	16 52	2 08	7·3	15 53	2 00	7·3	14 53	1 52	7·2	13 54	1 44	7·2	12 54	1 37	7·2	263	277
84	96	17 54	1 57	6·3	16 54	1 50	6·3	15 55	1 43	6·2	14 55	1 36	6·2	13 55	1 30	6·2	12 56	1 23	6·2	264	276
85	95	17 56	1 37	5·3	16 56	1 32	5·2	15 56	1 26	5·2	14 56	1 20	5·2	13 57	1 15	5·2	12 57	1 09	5·1	265	275
86	94	17 57	1 18	4·2	16 57	1 13	4·2	15 58	1 09	4·2	14 58	1 04	4·1	13 58	1 00	4·1	12 58	0 55	4·1	266	274
87	93	17 58	0 58	3·2	16 59	0 55	3·1	15 59	0 52	3·1	14 59	0 48	3·1	13 59	0 45	3·1	12 59	0 42	3·1	267	273
88	92	17 59	0 39	2·1	16 59	0 37	2·1	15 59	0 34	2·1	14 59	0 32	2·1	13 59	0 30	2·1	13 00	0 28	2·1	268	272
89	91	18 00	0 19	1·1	17 00	0 18	1·0	16 00	0 17	1·0	15 00	0 16	1·0	14 00	0 15	1·0	13 00	0 14	1·0	269	271
90	90	18 00	0 00	0·0	17 00	0 00	0·0	16 00	0 00	0·0	15 00	0 00	0·0	14 00	0 00	0·0	13 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (−) for 90° < LHA < 270°
Dec:(−) for Lat. contrary name

Z_1: same sign as B
Z_2: (−) for F > 90°

Lat. / A		78°			79°			80°			81°			82°			83°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
0	180	0 00	12 00	90·0	0 00	11 00	90·0	0 00	10 00	90·0	0 00	9 00	90·0	0 00	8 00	90·0	0 00	7 00	90·0	180	360
1	179	0 12	12 00	89·0	0 11	11 00	89·0	0 10	10 00	89·0	0 09	9 00	89·0	0 08	8 00	89·0	0 07	7 00	89·0	181	359
2	178	0 25	12 00	88·0	0 23	11 00	88·0	0 21	10 00	88·0	0 19	9 00	88·0	0 17	8 00	88·0	0 15	7 00	88·0	182	358
3	177	0 37	11 59	87·1	0 34	10 59	87·1	0 31	9 59	87·0	0 28	8 59	87·0	0 25	7 59	87·0	0 22	6 59	87·0	183	357
4	176	0 50	11 58	86·1	0 46	10 58	86·1	0 42	9 59	86·1	0 38	8 59	86·0	0 33	7 59	86·0	0 29	6 59	86·0	184	356
5	175	1 02	11 57	85·1	0 57	10 58	85·1	0 52	9 58	85·1	0 47	8 58	85·1	0 42	7 58	85·0	0 37	6 58	85·0	185	355
6	174	1 15	11 56	84·1	1 09	10 56	84·1	1 02	9 57	84·1	0 56	8 57	84·1	0 50	7 57	84·1	0 44	6 58	84·0	186	354
7	173	1 27	11 55	83·2	1 20	10 55	83·1	1 13	9 56	83·1	1 06	8 56	83·1	0 58	7 56	83·1	0 51	6 57	83·1	187	353
8	172	1 39	11 53	82·2	1 31	10 54	82·1	1 23	9 54	82·1	1 15	8 55	82·1	1 07	7 55	82·1	0 58	6 56	82·1	188	352
9	171	1 52	11 51	81·2	1 43	10 52	81·2	1 33	9 53	81·1	1 24	8 53	81·1	1 15	7 54	81·1	1 06	6 55	81·1	189	351
10	170	2 04	11 49	80·2	1 54	10 50	80·2	1 44	9 51	80·1	1 33	8 52	80·1	1 23	7 53	80·1	1 13	6 54	80·1	190	350
11	169	2 16	11 47	79·2	2 05	10 48	79·2	1 54	9 49	79·2	1 43	8 50	79·1	1 31	7 51	79·1	1 20	6 52	79·1	191	349
12	168	2 29	11 45	78·3	2 16	10 46	78·2	2 04	9 47	78·2	1 52	8 48	78·1	1 39	7 50	78·1	1 27	6 51	78·1	192	348
13	167	2 41	11 42	77·3	2 28	10 43	77·2	2 14	9 45	77·2	2 01	8 46	77·2	1 48	7 48	77·1	1 34	6 49	77·1	193	347
14	166	2 53	11 39	76·3	2 39	10 41	76·2	2 24	9 43	76·2	2 10	8 44	76·2	1 56	7 46	76·1	1 41	6 48	76·1	194	346
15	165	3 05	11 36	75·3	2 50	10 38	75·3	2 35	9 40	75·2	2 19	8 42	75·2	2 04	7 44	75·1	1 48	6 46	75·1	195	345
16	164	3 17	11 33	74·3	3 01	10 35	74·3	2 45	9 37	74·2	2 28	8 39	74·2	2 12	7 42	74·1	1 56	6 44	74·1	196	344
17	163	3 29	11 29	73·4	3 12	10 32	73·3	2 55	9 34	73·2	2 37	8 37	73·2	2 20	7 39	73·2	2 03	6 42	73·1	197	343
18	162	3 41	11 26	72·4	3 23	10 28	72·3	3 05	9 31	72·3	2 46	8 34	72·2	2 28	7 37	72·2	2 09	6 40	72·1	198	342
19	161	3 53	11 22	71·4	3 34	10 25	71·3	3 14	9 28	71·3	2 55	8 31	71·2	2 36	7 34	71·2	2 16	6 37	71·1	199	341
20	160	4 05	11 18	70·4	3 45	10 21	70·3	3 24	9 24	70·3	3 04	8 28	70·2	2 44	7 31	70·2	2 23	6 35	70·1	200	340
21	159	4 16	11 13	69·4	3 55	10 17	69·4	3 34	9 21	69·3	3 13	8 25	69·2	2 52	7 28	69·2	2 30	6 32	69·1	201	339
22	158	4 28	11 09	68·4	4 06	10 13	68·4	3 44	9 17	68·3	3 22	8 21	68·2	2 59	7 25	68·2	2 37	6 30	68·1	202	338
23	157	4 40	11 04	67·5	4 17	10 09	67·4	3 53	9 13	67·3	3 30	8 18	67·3	3 07	7 22	67·2	2 44	6 27	67·2	203	337
24	156	4 51	10 59	66·5	4 27	10 04	66·4	4 03	9 09	66·3	3 39	8 14	66·3	3 15	7 19	66·2	2 50	6 24	66·2	204	336
25	155	5 02	10 54	65·5	4 38	9 59	65·4	4 13	9 05	65·3	3 47	8 10	65·3	3 22	7 16	65·2	2 57	6 21	65·2	205	335
26	154	5 14	10 49	64·5	4 48	9 55	64·4	4 22	9 00	64·3	3 56	8 06	64·3	3 30	7 12	64·2	3 04	6 18	64·2	206	334
27	153	5 25	10 43	63·5	4 58	9 50	63·4	4 31	8 56	63·4	4 04	8 02	63·3	3 37	7 08	63·2	3 10	6 15	63·2	207	333
28	152	5 36	10 38	62·5	5 08	9 44	62·4	4 41	8 51	62·4	4 13	7 58	62·3	3 45	7 04	62·2	3 17	6 11	62·2	208	332
29	151	5 47	10 32	61·5	5 18	9 39	61·4	4 50	8 46	61·4	4 21	7 53	61·3	3 52	7 00	61·2	3 23	6 08	61·2	209	331
30	150	5 58	10 26	60·5	5 28	9 33	60·5	4 59	8 41	60·4	4 29	7 49	60·3	3 59	6 56	60·2	3 30	6 04	60·2	210	330
31	149	6 09	10 20	59·6	5 38	9 28	59·5	5 08	8 36	59·4	4 37	7 44	59·3	4 07	6 52	59·2	3 36	6 00	59·2	211	329
32	148	6 20	10 13	58·6	5 48	9 22	58·5	5 17	8 30	58·4	4 45	7 39	58·3	4 14	6 48	58·3	3 42	5 57	58·2	212	328
33	147	6 30	10 06	57·6	5 58	9 16	57·5	5 26	8 25	57·4	4 53	7 34	57·3	4 21	6 43	57·3	3 48	5 53	57·2	213	327
34	146	6 41	10 00	56·6	6 08	9 09	56·5	5 34	8 19	56·4	5 01	7 29	56·3	4 28	6 39	56·3	3 54	5 49	56·2	214	326
35	145	6 51	9 53	55·6	6 17	9 03	55·5	5 43	8 13	55·4	5 09	7 24	55·3	4 35	6 34	55·3	4 00	5 45	55·2	215	325
36	144	7 01	9 45	54·6	6 26	8 56	54·5	5 51	8 07	54·4	5 17	7 18	54·3	4 42	6 29	54·3	4 06	5 40	54·2	216	324
37	143	7 11	9 38	53·6	6 36	8 49	53·5	6 00	8 01	53·4	5 24	7 13	53·3	4 48	6 24	53·3	4 12	5 36	53·2	217	323
38	142	7 21	9 31	52·6	6 45	8 43	52·5	6 08	7 55	52·4	5 32	7 07	52·3	4 55	6 19	52·3	4 18	5 32	52·2	218	322
39	141	7 31	9 23	51·6	6 54	8 35	51·5	6 16	7 48	51·4	5 39	7 01	51·3	5 01	6 14	51·3	4 24	5 27	51·2	219	321
40	140	7 41	9 15	50·6	7 03	8 28	50·5	6 25	7 42	50·4	5 46	6 55	50·3	5 08	6 09	50·3	4 30	5 22	50·2	220	320
41	139	7 50	9 07	49·6	7 11	8 21	49·5	6 32	7 35	49·4	5 53	6 49	49·4	5 14	6 03	49·3	4 35	5 18	49·2	221	319
42	138	8 00	8 59	48·6	7 20	8 13	48·5	6 40	7 28	48·4	6 01	6 43	48·4	5 21	5 58	48·3	4 41	5 13	48·2	222	318
43	137	8 09	8 50	47·6	7 29	8 05	47·5	6 48	7 21	47·4	6 07	6 36	47·4	5 27	5 52	47·3	4 46	5 08	47·2	223	317
44	136	8 18	8 42	46·6	7 37	7 58	46·5	6 56	7 14	46·4	6 14	6 30	46·4	5 33	5 46	46·3	4 51	5 03	46·2	224	316
45	135	8 27	8 33	45·6	7 45	7 50	45·5	7 03	7 06	45·4	6 21	6 23	45·4	5 39	5 41	45·3	4 57	4 58	45·2	225	315

Lat. / A		78°			79°			80°			81°			82°			83°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	8 27	8 33	45·6	7 45	7 50	45·5	7 03	7 06	45·4	6 21	6 23	45·4	5 39	5 41	45·3	4 57	4 58	45·2	225	315
46	134	8 36	8 24	44·6	7 53	7 41	44·5	7 11	6 59	44·4	6 28	6 17	44·4	5 45	5 35	44·3	5 02	4 53	44·2	226	314
47	133	8 45	8 15	43·6	8 01	7 33	43·5	7 18	6 51	43·4	6 34	6 10	43·4	5 51	5 28	43·3	5 07	4 47	43·2	227	313
48	132	8 53	8 06	42·6	8 09	7 25	42·5	7 25	6 44	42·4	6 41	6 03	42·4	5 56	5 22	42·3	5 12	4 42	42·2	228	312
49	131	9 02	7 56	41·6	8 17	7 16	41·5	7 32	6 36	41·4	6 47	5 56	41·4	6 02	5 16	41·3	5 17	4 36	41·2	229	311
50	130	9 10	7 47	40·6	8 24	7 07	40·5	7 39	6 28	40·4	6 53	5 49	40·3	6 07	5 10	40·3	5 21	4 31	40·2	230	310
51	129	9 18	7 37	39·6	8 32	6 58	39·5	7 45	6 20	39·4	6 59	5 42	39·3	6 13	5 03	39·3	5 26	4 25	39·2	231	309
52	128	9 26	7 27	38·6	8 39	6 49	38·5	7 52	6 12	38·4	7 05	5 34	38·3	6 18	4 57	38·3	5 31	4 19	38·2	232	308
53	127	9 33	7 17	37·6	8 46	6 40	37·5	7 58	6 03	37·4	7 11	5 27	37·3	6 23	4 50	37·3	5 35	4 14	37·2	233	307
54	126	9 41	7 07	36·6	8 53	6 31	36·5	8 05	5 55	36·4	7 16	5 19	36·3	6 28	4 43	36·3	5 39	4 08	36·2	234	306
55	125	9 48	6 57	35·6	9 00	6 22	35·5	8 11	5 47	35·4	7 22	5 11	35·3	6 33	4 37	35·3	5 44	4 02	35·2	235	305
56	124	9 56	6 47	34·6	9 06	6 12	34·5	8 17	5 38	34·4	7 27	5 04	34·3	6 38	4 30	34·3	5 48	3 56	34·2	236	304
57	123	10 03	6 36	33·6	9 13	6 03	33·5	8 22	5 29	33·4	7 32	4 56	33·3	6 42	4 23	33·3	5 52	3 50	33·2	237	303
58	122	10 09	6 26	32·6	9 19	5 53	32·5	8 28	5 20	32·4	7 37	4 48	32·3	6 47	4 16	32·3	5 56	3 43	32·2	238	302
59	121	10 16	6 15	31·6	9 25	5 43	31·5	8 34	5 11	31·4	7 42	4 40	31·3	6 51	4 08	31·2	6 00	3 37	31·2	239	301
60	120	10 22	6 04	30·6	9 31	5 33	30·5	8 39	5 02	30·4	7 47	4 32	30·3	6 55	4 01	30·2	6 04	3 31	30·2	240	300
61	119	10 29	5 53	29·5	9 36	5 23	29·5	8 44	4 53	29·4	7 52	4 23	29·3	6 59	3 54	29·2	6 07	3 24	29·2	241	299
62	118	10 35	5 42	28·5	9 42	5 13	28·4	8 49	4 44	28·4	7 56	4 15	28·3	7 04	3 46	28·2	6 11	3 18	28·2	242	298
63	117	10 41	5 31	27·5	9 47	5 03	27·4	8 54	4 35	27·4	8 01	4 07	27·3	7 07	3 39	27·2	6 14	3 11	27·2	243	297
64	116	10 46	5 19	26·5	9 52	4 52	26·4	8 59	4 25	26·3	8 05	3 58	26·3	7 11	3 32	26·2	6 17	3 05	26·2	244	296
65	115	10 52	5 08	25·5	9 57	4 42	25·4	9 03	4 16	25·3	8 09	3 50	25·3	7 15	3 24	25·2	6 20	2 58	25·2	245	295
66	114	10 57	4 56	24·5	10 02	4 31	24·4	9 08	4 06	24·3	8 13	3 41	24·3	7 18	3 16	24·2	6 24	2 52	24·2	246	294
67	113	11 02	4 45	23·5	10 07	4 21	23·4	9 12	3 56	23·3	8 17	3 32	23·3	7 22	3 09	23·2	6 26	2 45	23·2	247	293
68	112	11 07	4 33	22·4	10 11	4 10	22·4	9 16	3 47	22·3	8 20	3 24	22·2	7 25	3 01	22·2	6 29	2 38	22·1	248	292
69	111	11 12	4 21	21·4	10 16	3 59	21·4	9 20	3 37	21·3	8 24	3 15	21·2	7 28	2 53	21·2	6 32	2 31	21·1	249	291
70	110	11 16	4 09	20·4	10 20	3 48	20·3	9 23	3 27	20·3	8 27	3 06	20·2	7 31	2 45	20·2	6 35	2 24	20·1	250	290
71	109	11 20	3 58	19·4	10 24	3 37	19·3	9 27	3 17	19·3	8 30	2 57	19·2	7 34	2 37	19·2	6 37	2 17	19·1	251	289
72	108	11 24	3 45	18·4	10 27	3 26	18·3	9 30	3 07	18·3	8 33	2 48	18·2	7 36	2 29	18·2	6 39	2 10	18·1	252	288
73	107	11 28	3 33	17·4	10 31	3 15	17·3	9 34	2 57	17·2	8 36	2 39	17·2	7 39	2 21	17·2	6 42	2 03	17·1	253	287
74	106	11 32	3 21	16·3	10 34	3 04	16·3	9 37	2 47	16·2	8 39	2 30	16·2	7 41	2 13	16·1	6 44	1 56	16·1	254	286
75	105	11 35	3 09	15·3	10 37	2 53	15·3	9 39	2 37	15·2	8 41	2 21	15·2	7 44	2 05	15·1	6 46	1 49	15·1	255	285
76	104	11 38	2 57	14·3	10 40	2 42	14·3	9 42	2 27	14·2	8 44	2 12	14·2	7 46	1 57	14·1	6 47	1 42	14·1	256	284
77	103	11 41	2 44	13·3	10 43	2 30	13·2	9 44	2 16	13·2	8 46	2 02	13·2	7 48	1 49	13·1	6 49	1 35	13·1	257	283
78	102	11 44	2 32	12·3	10 45	2 19	12·2	9 47	2 06	12·2	8 48	1 53	12·1	7 49	1 40	12·1	6 51	1 28	12·1	258	282
79	101	11 47	2 19	11·2	10 48	2 07	11·2	9 49	1 56	11·2	8 50	1 44	11·1	7 51	1 32	11·1	6 52	1 21	11·1	259	281
80	100	11 49	2 07	10·2	10 50	1 56	10·2	9 51	1 45	10·2	8 52	1 35	10·1	7 53	1 24	10·1	6 54	1 13	10·1	260	280
81	99	11 51	1 54	9·2	10 52	1 45	9·2	9 53	1 35	9·1	8 53	1 25	9·1	7 54	1 16	9·1	6 55	1 06	9·1	261	279
82	98	11 53	1 42	8·2	10 53	1 33	8·1	9 54	1 24	8·1	8 55	1 16	8·1	7 55	1 07	8·1	6 56	0 59	8·1	262	278
83	97	11 55	1 29	7·2	10 55	1 21	7·1	9 55	1 14	7·1	8 56	1 06	7·1	7 56	0 59	7·1	6 57	0 51	7·1	263	277
84	96	11 56	1 16	6·1	10 56	1 10	6·1	9 57	1 03	6·1	8 57	0 57	6·1	7 57	0 50	6·1	6 58	0 44	6·0	264	276
85	95	11 57	1 04	5·1	10 57	0 58	5·1	9 58	0 53	5·1	8 58	0 47	5·1	7 58	0 42	5·0	6 58	0 37	5·0	265	275
86	94	11 58	0 51	4·1	10 58	0 47	4·1	9 59	0 42	4·1	8 59	0 38	4·0	7 59	0 34	4·0	6 59	0 29	4·0	266	274
87	93	11 59	0 38	3·1	10 59	0 35	3·1	9 59	0 32	3·0	8 59	0 28	3·0	7 59	0 25	3·0	6 59	0 22	3·0	267	273
88	92	12 00	0 26	2·0	11 00	0 23	2·0	10 00	0 21	2·0	9 00	0 19	2·0	8 00	0 17	2·0	7 00	0 15	2·0	268	272
89	91	12 00	0 13	1·0	11 00	0 12	1·0	10 00	0 11	1·0	9 00	0 10	1·0	8 00	0 08	1·0	7 00	0 07	1·0	269	271
90	90	12 00	0 00	0·0	11 00	0 00	0·0	10 00	0 00	0·0	9 00	0 00	0·0	8 00	0 00	0·0	7 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

SIGHT REDUCTION TABLE

B: (–) for 90° < LHA < 270°
Dec:(–) for Lat. contrary name

Z_1: same sign as B
Z_2: (–) for F > 90°

Lat. / A		84°			85°			86°			87°			88°			89°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
0	180	0 00	6 00	90·0	0 00	5 00	90·0	0 00	4 00	90·0	0 00	3 00	90·0	0 00	2 00	90·0	0 00	1 00	90·0	180	360
1	179	0 06	6 00	89·0	0 05	5 00	89·0	0 04	4 00	89·0	0 03	3 00	89·0	0 02	2 00	89·0	0 01	1 00	89·0	181	359
2	178	0 13	6 00	88·0	0 10	5 00	88·0	0 08	4 00	88·0	0 06	3 00	88·0	0 04	2 00	88·0	0 02	1 00	88·0	182	358
3	177	0 19	6 00	87·0	0 16	5 00	87·0	0 13	4 00	87·0	0 09	3 00	87·0	0 06	2 00	87·0	0 03	1 00	87·0	183	357
4	176	0 25	5 59	86·0	0 21	4 59	86·0	0 17	3 59	86·0	0 13	3 00	86·0	0 08	2 00	86·0	0 04	1 00	86·0	184	356
5	175	0 31	5 59	85·0	0 26	4 59	85·0	0 21	3 59	85·0	0 16	2 59	85·0	0 10	2 00	85·0	0 05	1 00	85·0	185	355
6	174	0 38	5 58	84·0	0 31	4 58	84·0	0 25	3 59	84·0	0 19	2 59	84·0	0 13	1 59	84·0	0 06	1 00	84·0	186	354
7	173	0 44	5 57	83·0	0 37	4 58	83·0	0 29	3 58	83·0	0 22	2 59	83·0	0 15	1 59	83·0	0 07	1 00	83·0	187	353
8	172	0 50	5 57	82·0	0 42	4 57	82·0	0 33	3 58	82·0	0 25	2 58	82·0	0 17	1 59	82·0	0 08	0 59	82·0	188	352
9	171	0 56	5 56	81·0	0 47	4 56	81·0	0 38	3 57	81·0	0 28	2 58	81·0	0 19	1 59	81·0	0 09	0 59	81·0	189	351
10	170	1 02	5 55	80·1	0 52	4 55	80·0	0 42	3 56	80·0	0 31	2 57	80·0	0 21	1 58	80·0	0 10	0 59	80·0	190	350
11	169	1 09	5 53	79·1	0 57	4 55	79·0	0 46	3 56	79·0	0 34	2 57	79·0	0 23	1 58	79·0	0 11	0 59	79·0	191	349
12	168	1 15	5 52	78·1	1 02	4 53	78·0	0 50	3 55	78·0	0 37	2 56	78·0	0 25	1 57	78·0	0 12	0 59	78·0	192	348
13	167	1 21	5 51	77·1	1 07	4 52	77·0	0 54	3 54	77·0	0 40	2 55	77·0	0 27	1 57	77·0	0 13	0 58	77·0	193	347
14	166	1 27	5 49	76·1	1 12	4 51	76·1	0 58	3 53	76·0	0 44	2 55	76·0	0 29	1 56	76·0	0 15	0 58	76·0	194	346
15	165	1 33	5 48	75·1	1 18	4 50	75·1	1 02	3 52	75·0	0 47	2 54	75·0	0 31	1 56	75·0	0 16	0 58	75·0	195	345
16	164	1 39	5 46	74·1	1 23	4 48	74·1	1 06	3 51	74·0	0 50	2 53	74·0	0 33	1 55	74·0	0 17	0 58	74·0	196	344
17	163	1 45	5 44	73·1	1 28	4 47	73·1	1 10	3 50	73·0	0 53	2 52	73·0	0 35	1 55	73·0	0 18	0 57	73·0	197	343
18	162	1 51	5 42	72·1	1 33	4 45	72·1	1 14	3 48	72·0	0 56	2 51	72·0	0 37	1 54	72·0	0 19	0 57	72·0	198	342
19	161	1 57	5 41	71·1	1 38	4 44	71·1	1 18	3 47	71·0	0 59	2 50	71·0	0 39	1 53	71·0	0 20	0 57	71·0	199	341
20	160	2 03	5 38	70·1	1 42	4 42	70·1	1 22	3 46	70·0	1 02	2 49	70·0	0 41	1 53	70·0	0 21	0 56	70·0	200	340
21	159	2 09	5 36	69·1	1 47	4 40	69·1	1 26	3 44	69·0	1 04	2 48	69·0	0 43	1 52	69·0	0 22	0 56	69·0	201	339
22	158	2 15	5 34	68·1	1 52	4 38	68·1	1 30	3 43	68·0	1 07	2 47	68·0	0 45	1 51	68·0	0 22	0 56	68·0	202	338
23	157	2 20	5 32	67·1	1 57	4 36	67·1	1 34	3 41	67·1	1 10	2 46	67·0	0 47	1 50	67·0	0 23	0 55	67·0	203	337
24	156	2 26	5 29	66·1	2 02	4 34	66·1	1 38	3 39	66·1	1 13	2 44	66·0	0 49	1 50	66·0	0 24	0 55	66·0	204	336
25	155	2 32	5 26	65·1	2 07	4 32	65·1	1 41	3 38	65·1	1 16	2 43	65·0	0 51	1 49	65·0	0 25	0 54	65·0	205	335
26	154	2 38	5 24	64·1	2 11	4 30	64·1	1 45	3 36	64·1	1 19	2 42	64·0	0 53	1 48	64·0	0 26	0 54	64·0	206	334
27	153	2 43	5 21	63·1	2 16	4 27	63·1	1 49	3 34	63·1	1 22	2 40	63·0	0 54	1 47	63·0	0 27	0 53	63·0	207	333
28	152	2 49	5 18	62·1	2 21	4 25	62·1	1 53	3 32	62·1	1 24	2 39	62·0	0 56	1 46	62·0	0 28	0 53	62·0	208	332
29	151	2 54	5 15	61·1	2 25	4 23	61·1	1 56	3 30	61·1	1 27	2 37	61·0	0 58	1 45	61·0	0 29	0 52	61·0	209	331
30	150	3 00	5 12	60·1	2 30	4 20	60·1	2 00	3 28	60·1	1 30	2 36	60·0	1 00	1 44	60·0	0 30	0 52	60·0	210	330
31	149	3 05	5 09	59·1	2 34	4 17	59·1	2 04	3 26	59·1	1 33	2 34	59·0	1 02	1 43	59·0	0 31	0 51	59·0	211	329
32	148	3 11	5 06	58·1	2 39	4 15	58·1	2 07	3 24	58·1	1 35	2 33	58·0	1 04	1 42	58·0	0 32	0 51	58·0	212	328
33	147	3 16	5 02	57·1	2 43	4 12	57·1	2 11	3 21	57·1	1 38	2 31	57·0	1 05	1 41	57·0	0 33	0 50	57·0	213	327
34	146	3 21	4 59	56·1	2 48	4 09	56·1	2 14	3 19	56·1	1 41	2 29	56·0	1 07	1 39	56·0	0 34	0 50	56·0	214	326
35	145	3 26	4 55	55·1	2 52	4 06	55·1	2 18	3 17	55·1	1 43	2 27	55·0	1 09	1 38	55·0	0 34	0 49	55·0	215	325
36	144	3 31	4 52	54·1	2 56	4 03	54·1	2 21	3 14	54·1	1 46	2 26	54·0	1 11	1 37	54·0	0 35	0 49	54·0	216	324
37	143	3 36	4 48	53·2	3 00	4 00	53·1	2 24	3 12	53·1	1 48	2 24	53·0	1 12	1 36	53·0	0 36	0 48	53·0	217	323
38	142	3 41	4 44	52·2	3 05	3 57	52·1	2 28	3 09	52·1	1 51	2 22	52·0	1 14	1 35	52·0	0 37	0 47	52·0	218	322
39	141	3 46	4 40	51·2	3 09	3 53	51·1	2 31	3 07	51·1	1 53	2 20	51·0	1 16	1 33	51·0	0 38	0 47	51·0	219	321
40	140	3 51	4 36	50·2	3 13	3 50	50·1	2 34	3 04	50·1	1 56	2 18	50·0	1 17	1 32	50·0	0 39	0 46	50·0	220	320
41	139	3 56	4 32	49·2	3 17	3 47	49·1	2 37	3 01	49·1	1 58	2 16	49·0	1 19	1 31	49·0	0 39	0 45	49·0	221	319
42	138	4 01	4 28	48·2	3 21	3 43	48·1	2 41	2 58	48·1	2 00	2 14	48·0	1 20	1 29	48·0	0 40	0 45	48·0	222	318
43	137	4 05	4 24	47·2	3 24	3 40	47·1	2 44	2 56	47·1	2 03	2 12	47·0	1 22	1 28	47·0	0 41	0 44	47·0	223	317
44	136	4 10	4 19	46·2	3 28	3 36	46·1	2 47	2 53	46·1	2 05	2 10	46·0	1 23	1 26	46·0	0 42	0 43	46·0	224	316
45	135	4 14	4 15	45·2	3 32	3 32	45·1	2 50	2 50	45·1	2 07	2 07	45·0	1 25	1 25	45·0	0 42	0 42	45·0	225	315

Lat. / A		84°			85°			86°			87°			88°			89°			Lat. / A	
LHA/F		A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	A/H	B/P	Z_1/Z_2	LHA	
°	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	° ′	° ′	°	°	°
45	135	4 14	4 15	45·2	3 32	3 32	45·1	2 50	2 50	45·1	2 07	2 07	45·0	1 25	1 25	45·0	0 42	0 42	45·0	225	315
46	134	4 19	4 11	44·2	3 36	3 29	44·1	2 53	2 47	44·1	2 09	2 05	44·0	1 26	1 23	44·0	0 43	0 42	44·0	226	314
47	133	4 23	4 06	43·2	3 39	3 25	43·1	2 55	2 44	43·1	2 12	2 03	43·0	1 28	1 22	43·0	0 44	0 41	43·0	227	313
48	132	4 27	4 01	42·2	3 43	3 21	42·1	2 58	2 41	42·1	2 14	2 01	42·0	1 29	1 20	42·0	0 45	0 40	42·0	228	312
49	131	4 31	3 57	41·2	3 46	3 17	41·1	3 01	2 38	41·1	2 16	1 58	41·0	1 31	1 19	41·0	0 45	0 39	41·0	229	311
50	130	4 36	3 52	40·2	3 50	3 13	40·1	3 04	2 34	40·1	2 18	1 56	40·0	1 32	1 17	40·0	0 46	0 39	40·0	230	310
51	129	4 40	3 47	39·2	3 53	3 09	39·1	3 06	2 31	39·1	2 20	1 53	39·0	1 33	1 16	39·0	0 47	0 38	39·0	231	309
52	128	4 43	3 42	38·2	3 56	3 05	38·1	3 09	2 28	38·1	2 22	1 51	38·0	1 35	1 14	38·0	0 47	0 37	38·0	232	308
53	127	4 47	3 37	37·2	3 59	3 01	37·1	3 12	2 25	37·1	2 24	1 48	37·0	1 36	1 12	37·0	0 48	0 36	37·0	233	307
54	126	4 51	3 32	36·1	4 03	2 57	36·1	3 14	2 21	36·1	2 26	1 46	36·0	1 37	1 11	36·0	0 49	0 35	36·0	234	306
55	125	4 55	3 27	35·1	4 06	2 52	35·1	3 17	2 18	35·1	2 27	1 43	35·0	1 38	1 09	35·0	0 49	0 34	35·0	235	305
56	124	4 58	3 22	34·1	4 09	2 48	34·1	3 19	2 14	34·1	2 29	1 41	34·0	1 39	1 07	34·0	0 50	0 34	34·0	236	304
57	123	5 02	3 17	33·1	4 12	2 44	33·1	3 21	2 11	33·1	2 31	1 38	33·0	1 41	1 05	33·0	0 50	0 33	33·0	237	303
58	122	5 05	3 11	32·1	4 14	2 39	32·1	3 23	2 07	32·1	2 33	1 35	32·0	1 42	1 04	32·0	0 51	0 32	32·0	238	302
59	121	5 08	3 06	31·1	4 17	2 35	31·1	3 26	2 04	31·1	2 34	1 33	31·0	1 43	1 02	31·0	0 51	0 31	31·0	239	301
60	120	5 12	3 00	30·1	4 20	2 30	30·1	3 28	2 00	30·1	2 36	1 30	30·0	1 44	1 00	30·0	0 52	0 30	30·0	240	300
61	119	5 15	2 55	29·1	4 22	2 26	29·1	3 30	1 56	29·1	2 37	1 27	29·0	1 45	0 58	29·0	0 52	0 29	29·0	241	299
62	118	5 18	2 49	28·1	4 25	2 21	28·1	3 32	1 53	28·1	2 39	1 25	28·0	1 46	0 56	28·0	0 53	0 28	28·0	242	298
63	117	5 21	2 44	27·1	4 27	2 16	27·1	3 34	1 49	27·1	2 40	1 22	27·0	1 47	0 54	27·0	0 53	0 27	27·0	243	297
64	116	5 23	2 38	26·1	4 30	2 12	26·1	3 36	1 45	26·1	2 42	1 19	26·0	1 48	0 53	26·0	0 54	0 26	26·0	244	296
65	115	5 26	2 33	25·1	4 32	2 07	25·1	3 37	1 42	25·1	2 43	1 16	25·0	1 49	0 51	25·0	0 54	0 25	25·0	245	295
66	114	5 29	2 27	24·1	4 34	2 02	24·1	3 39	1 38	24·1	2 44	1 13	24·0	1 50	0 49	24·0	0 55	0 24	24·0	246	294
67	113	5 31	2 21	23·1	4 36	1 57	23·1	3 41	1 34	23·1	2 46	1 10	23·0	1 50	0 47	23·0	0 55	0 23	23·0	247	293
68	112	5 34	2 15	22·1	4 38	1 53	22·1	3 42	1 30	22·0	2 47	1 07	22·0	1 51	0 45	22·0	0 56	0 22	22·0	248	292
69	111	5 36	2 09	21·1	4 40	1 48	21·1	3 44	1 26	21·0	2 48	1 05	21·0	1 52	0 43	21·0	0 56	0 22	21·0	249	291
70	110	5 38	2 04	20·1	4 42	1 43	20·1	3 46	1 22	20·0	2 49	1 02	20·0	1 53	0 41	20·0	0 56	0 21	20·0	250	290
71	109	5 40	1 58	19·1	4 44	1 38	19·1	3 47	1 18	19·0	2 50	0 59	19·0	1 53	0 39	19·0	0 57	0 20	19·0	251	289
72	108	5 42	1 52	18·1	4 45	1 33	18·1	3 48	1 14	18·0	2 51	0 56	18·0	1 54	0 37	18·0	0 57	0 19	18·0	252	288
73	107	5 44	1 46	17·1	4 47	1 28	17·1	3 49	1 10	17·0	2 52	0 53	17·0	1 55	0 35	17·0	0 57	0 18	17·0	253	287
74	106	5 46	1 40	16·1	4 48	1 23	16·1	3 51	1 06	16·0	2 53	0 50	16·0	1 55	0 33	16·0	0 58	0 17	16·0	254	286
75	105	5 48	1 33	15·1	4 50	1 18	15·1	3 52	1 02	15·0	2 54	0 47	15·0	1 56	0 31	15·0	0 58	0 16	15·0	255	285
76	104	5 49	1 27	14·1	4 51	1 13	14·1	3 53	0 58	14·0	2 55	0 44	14·0	1 56	0 29	14·0	0 58	0 15	14·0	256	284
77	103	5 51	1 21	13·1	4 52	1 08	13·0	3 54	0 54	13·0	2 55	0 41	13·0	1 57	0 27	13·0	0 58	0 13	13·0	257	283
78	102	5 52	1 15	12·1	4 53	1 03	12·0	3 55	0 50	12·0	2 56	0 37	12·0	1 57	0 25	12·0	0 59	0 12	12·0	258	282
79	101	5 53	1 09	11·1	4 54	0 57	11·0	3 56	0 46	11·0	2 57	0 34	11·0	1 58	0 23	11·0	0 59	0 11	11·0	259	281
80	100	5 55	1 03	10·1	4 55	0 52	10·0	3 56	0 42	10·0	2 57	0 31	10·0	1 58	0 21	10·0	0 59	0 10	10·0	260	280
81	99	5 56	0 57	9·0	4 56	0 47	9·0	3 57	0 38	9·0	2 58	0 28	9·0	1 59	0 19	9·0	0 59	0 09	9·0	261	279
82	98	5 56	0 50	8·0	4 57	0 42	8·0	3 58	0 33	8·0	2 58	0 25	8·0	1 59	0 17	8·0	0 59	0 08	8·0	262	278
83	97	5 57	0 44	7·0	4 58	0 37	7·0	3 58	0 29	7·0	2 59	0 22	7·0	1 59	0 15	7·0	1 00	0 07	7·0	263	277
84	96	5 58	0 38	6·0	4 58	0 31	6·0	3 59	0 25	6·0	2 59	0 19	6·0	1 59	0 13	6·0	1 00	0 06	6·0	264	276
85	95	5 59	0 31	5·0	4 59	0 26	5·0	3 59	0 21	5·0	2 59	0 15	5·0	2 00	0 10	5·0	1 00	0 05	5·0	265	275
86	94	5 59	0 25	4·0	4 59	0 21	4·0	3 59	0 17	4·0	3 00	0 13	4·0	2 00	0 08	4·0	1 00	0 04	4·0	266	274
87	93	6 00	0 19	3·0	5 00	0 16	3·0	4 00	0 13	3·0	3 00	0 09	3·0	2 00	0 06	3·0	1 00	0 03	3·0	267	273
88	92	6 00	0 13	2·0	5 00	0 10	2·0	4 00	0 08	2·0	3 00	0 06	2·0	2 00	0 04	2·0	1 00	0 02	2·0	268	272
89	91	6 00	0 06	1·0	5 00	0 05	1·0	4 00	0 04	1·0	3 00	0 03	1·0	2 00	0 02	1·0	1 00	0 01	1·0	269	271
90	90	6 00	0 00	0·0	5 00	0 00	0·0	4 00	0 00	0·0	3 00	0 00	0·0	2 00	0 00	0·0	1 00	0 00	0·0	270	270

N. Lat: for LHA > 180° ... $Z_n = Z$
for LHA < 180° ... $Z_n = 360° - Z$

S. Lat.: for LHA > 180° ... $Z_n = 180° - Z$
for LHA < 180° ... $Z_n = 180° + Z$

Sign of $corr_1$ for F′. *Reverse* sign if $F > 90°$. ↓

AUXILIARY TABLE

Sign for $corr_2$ for A′. ↓

F′ + / −	1 59	2 58	3 57	4 56	5 55	6 54	7 53	8 52	9 51	10 50	11 49	12 48	13 47	14 46	15 45	16 44	17 43	18 42	19 41	20 40	21 39	22 38	23 37	24 36	25 35	26 34	27 33	28 32	29 31	□ 30	− / + A′
P°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	$Z_2°$
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	89
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	88
3	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	87
4	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	86
5	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	3	3	85
6	0	0	0	0	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	84
7	0	0	0	0	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	83
8	0	0	0	1	1	1	1	1	1	1	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	4	4	4	4	4	82
9	0	0	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	3	4	4	4	4	4	4	5	5	81
10	0	0	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	80
11	0	0	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	79
12	0	0	1	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	5	5	6	6	6	6	78
13	0	0	1	1	1	1	2	2	2	2	2	3	3	3	3	4	4	4	4	4	5	5	5	5	6	6	6	6	7	7	77
14	0	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	7	76
15	0	1	1	1	1	2	2	2	2	3	3	3	3	4	4	4	4	5	5	5	5	6	6	6	6	7	7	7	8	8	75
16	0	1	1	1	1	2	2	2	2	3	3	3	4	4	4	4	5	5	5	6	6	6	6	7	7	7	7	8	8	8	74
17	0	1	1	1	1	2	2	2	3	3	3	4	4	4	4	5	5	5	6	6	6	6	7	7	7	8	8	8	8	9	73
18	0	1	1	1	2	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	6	7	7	7	8	8	8	9	9	9	72
19	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	7	7	8	8	8	9	9	9	10	71
20	0	1	1	1	2	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	8	8	8	9	9	9	10	10	10	70
21	0	1	1	1	2	2	3	3	3	4	4	4	5	5	5	6	6	6	7	7	8	8	8	9	9	9	10	10	10	11	69
22	0	1	1	1	2	2	3	3	3	4	4	4	5	5	6	6	6	7	7	7	8	8	9	9	9	10	10	10	11	11	68
23	0	1	1	2	2	2	3	3	4	4	4	5	5	5	6	6	7	7	7	8	8	9	9	9	10	10	11	11	11	12	67
24	0	1	1	2	2	2	3	3	4	4	4	5	5	6	6	7	7	7	8	8	9	9	9	10	10	11	11	11	12	12	66
25	0	1	1	2	2	3	3	3	4	4	5	5	5	6	6	7	7	8	8	8	9	9	10	10	11	11	11	12	12	13	65
26	0	1	1	2	2	3	3	4	4	4	5	5	6	6	7	7	7	8	8	9	9	10	10	11	11	11	12	12	13	13	64
27	0	1	1	2	2	3	3	4	4	5	5	5	6	6	7	7	8	8	9	9	10	10	10	11	11	12	12	13	13	14	63
28	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	8	9	9	10	10	11	11	12	12	13	13	14	14	62
29	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	61
30	0	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	60
31	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	9	10	10	11	11	12	12	13	13	14	14	15	15	59
32	1	1	2	2	3	3	4	4	5	5	6	6	7	7	8	8	9	10	10	11	11	12	12	13	13	14	14	15	15	16	58
33	1	1	2	2	3	3	4	4	5	5	6	7	7	8	8	9	9	10	10	11	11	12	13	13	14	14	15	15	16	16	57
34	1	1	2	2	3	3	4	4	5	6	6	7	7	8	8	9	10	10	11	11	12	12	13	13	14	15	15	16	16	17	56
35	1	1	2	2	3	3	4	5	5	6	6	7	7	8	9	9	10	10	11	11	12	13	13	14	14	15	15	16	17	17	55
36	1	1	2	2	3	4	4	5	5	6	6	7	8	8	9	9	10	11	11	12	12	13	14	14	15	15	16	16	17	18	54
37	1	1	2	2	3	4	4	5	5	6	7	7	8	8	9	10	10	11	11	12	13	13	14	14	15	16	16	17	17	18	53
38	1	1	2	2	3	4	4	5	6	6	7	7	8	9	9	10	10	11	12	12	13	14	14	15	15	16	17	17	18	18	52
39	1	1	2	3	3	4	4	5	6	6	7	8	8	9	9	10	11	11	12	13	13	14	14	15	16	16	17	18	18	19	51
40	1	1	2	3	3	4	4	5	6	6	7	8	8	9	10	10	11	12	12	13	13	14	15	15	16	17	17	18	19	19	50

F′ + / −	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	□	− / + A′
	59	58	57	56	55	54	53	52	51	50	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	
P°	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	$Z_2°$
41	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	49
42	1	1	2	3	3	4	5	5	6	7	7	8	9	9	10	11	11	12	13	13	14	15	15	16	17	17	18	19	19	20	48
43	1	1	2	3	3	4	5	5	6	7	8	8	9	10	10	11	12	12	13	14	14	15	16	16	17	18	18	19	20	20	47
44	1	1	2	3	3	4	5	6	6	7	8	8	9	10	10	11	12	13	13	14	15	15	16	17	17	18	19	19	20	21	46
45	1	1	2	3	4	4	5	6	6	7	8	8	9	10	11	11	12	13	13	14	15	16	16	17	18	18	19	20	21	21	45
46	1	1	2	3	4	4	5	6	6	7	8	9	9	10	11	12	12	13	14	14	15	16	17	17	18	19	19	20	21	22	44
47	1	1	2	3	4	4	5	6	7	7	8	9	10	10	11	12	12	13	14	15	15	16	17	18	18	19	20	20	21	22	43
48	1	1	2	3	4	4	5	6	7	7	8	9	10	10	11	12	13	13	14	15	16	16	17	18	19	19	20	21	22	22	42
49	1	2	2	3	4	5	5	6	7	8	8	9	10	11	11	12	13	14	14	15	16	17	17	18	19	20	20	21	22	23	41
50	1	2	2	3	4	5	5	6	7	8	8	9	10	11	11	12	13	14	15	15	16	17	18	18	19	20	21	21	22	23	40
51	1	2	2	3	4	5	5	6	7	8	9	9	10	11	12	12	13	14	15	16	16	17	18	19	19	20	21	22	23	23	39
52	1	2	2	3	4	5	6	6	7	8	9	9	10	11	12	13	13	14	15	16	17	17	18	19	20	20	21	22	23	24	38
53	1	2	2	3	4	5	6	6	7	8	9	10	10	11	12	13	14	14	15	16	17	18	18	19	20	21	22	22	23	24	37
54	1	2	2	3	4	5	6	6	7	8	9	10	11	11	12	13	14	15	15	16	17	18	19	19	20	21	22	23	23	24	36
55	1	2	2	3	4	5	6	7	7	8	9	10	11	11	12	13	14	15	16	16	17	18	19	20	20	21	22	23	24	25	35
56	1	2	2	3	4	5	6	7	7	8	9	10	11	12	12	13	14	15	16	17	17	18	19	20	21	22	22	23	24	25	34
57	1	2	3	3	4	5	6	7	8	8	9	10	11	12	13	13	14	15	16	17	18	18	19	20	21	22	23	23	24	25	33
58	1	2	3	3	4	5	6	7	8	8	9	10	11	12	13	14	14	15	16	17	18	19	20	20	21	22	23	24	25	25	32
59	1	2	3	3	4	5	6	7	8	9	9	10	11	12	13	14	15	15	16	17	18	19	20	21	21	22	23	24	25	26	31
60	1	2	3	3	4	5	6	7	8	9	10	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	23	24	25	26	30
61	1	2	3	3	4	5	6	7	8	9	10	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23	24	24	25	26	29
62	1	2	3	4	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	26	28
63	1	2	3	4	4	5	6	7	8	9	10	11	12	12	13	14	15	16	17	18	19	20	20	21	22	23	24	25	26	27	27
64	1	2	3	4	4	5	6	7	8	9	10	11	12	13	13	14	15	16	17	18	19	20	21	22	22	23	24	25	26	27	26
65	1	2	3	4	5	5	6	7	8	9	10	11	12	13	14	15	15	16	17	18	19	20	21	22	23	24	24	25	26	27	25
66	1	2	3	4	5	5	6	7	8	9	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25	26	26	27	24
67	1	2	3	4	5	6	6	7	8	9	10	11	12	13	14	15	16	17	17	18	19	20	21	22	23	24	25	26	27	28	23
68	1	2	3	4	5	6	6	7	8	9	10	11	12	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	22
69	1	2	3	4	5	6	7	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	21	22	23	24	25	26	27	28	21
70	1	2	3	4	5	6	7	8	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	23	24	25	26	27	28	20
71	1	2	3	4	5	6	7	8	9	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	26	27	28	19
72	1	2	3	4	5	6	7	8	9	10	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	18
73	1	2	3	4	5	6	7	8	9	10	11	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	17
74	1	2	3	4	5	6	7	8	9	10	11	12	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	16
75	1	2	3	4	5	6	7	8	9	10	11	12	13	14	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	15
76	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	16	17	18	19	20	21	22	23	24	25	26	27	28	29	14
77	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	19	20	21	22	23	24	25	26	27	28	29	13
78	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	22	23	24	25	26	27	28	29	12
79	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	27	28	29	11
80	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	10

For P > 80°, use 80°

For Z_2 < 10°, use 10°

USE OF CONCISE SIGHT REDUCTION TABLES (continued)

4. *Example.* (b) Required the altitude and azimuth of *Vega* on 2011 July 29 at UT $04^h\ 50^m$ from the estimated position 152° west, 15° south.

1. Assumed latitude	$Lat =$	15° S	
From the almanac	$GHA =$	99° 40′	
Assumed longitude		151° 40′ W	
Local hour angle	$LHA =$	308	
2. Reduction table, 1st entry $(Lat, LHA) = (15, 308)$	$A =$	49 34	$A° = 50$, $A' = 34$
	$B =$	+66 29	$Z_1 = +71{\cdot}7$, $LHA > 270°$
3. From the almanac	$Dec =$	−38 48	*Lat* and *Dec* contrary
Sum $= B + Dec$	$F =$	+27 41	$F° = 28$, $F' = 41$
4. Reduction table, 2nd entry $(A°, F°) = (50, 28)$	$H =$	17 34	$P° = 37$
			$Z_2 = 67{\cdot}8, Z_2{}° = 68$
5. Auxiliary table, 1st entry $(F', P°) = (41, 37)$	$corr_1 =$	−11	$F < 90°$, $F' > 29'$
Sum		17 23	
6. Auxiliary table, 2nd entry $(A', Z_2°) = (34, 68)$	$corr_2 =$	+10	$A' > 30'$
7. Sum = computed altitude	$H_C =$	+17° 33′	$F > 0°$
8. Azimuth, first component	$Z_1 =$	+71·7	same sign as B
second component	$Z_2 =$	+67·8	$F < 90°$, $F > 0°$
Sum = azimuth angle	$Z =$	139·5	
True azimuth	$Z_n =$	040°	S *Lat*, $LHA > 180°$

5. *Form for use with the Concise Sight Reduction Tables.* The form on the following page lays out the procedure explained on pages 284-285. Each step is shown, with notes and rules to ensure accuracy, rather than speed, throughout the calculation. The form is mainly intended for the calculation of star positions. It therefore includes the formation of the Greenwich hour of Aries (*GHA* Aries), and thus the Greenwich hour angle of the star (*GHA*) from its tabular sidereal hour angle (*SHA*). These calculations, included in step 1 of the form, can easily be replaced by the interpolation of *GHA* and *Dec* for the Sun, Moon or planets.

The form may be freely copied, however, acknowledgement of the source is requested.

Date & UT of observation h m s			**Body**	**Estimated Latitude & Longitude** ° ′ ° ′
Step	**Calculate Altitude & Azimuth**			**Summary of Rules & Notes**
Assumed latitude	*Lat* =	°		Nearest estimated latitude, integral number of degrees.
Assumed longitude	*Long* =	° ′		Choose *Long* so that *LHA* has integral number of degrees.
1. From the almanac:	*Dec* =	° ′		Record the *Dec* for use in Step 3.
GHA Aries h	=	° ′		Needed if using *SHA*. Tabular value.
Increment m s	=	° ′		for minutes and seconds of time.
SHA	*SHA* =	° ′		
GHA = *GHA Aries* + *SHA*	*GHA* =	° ′		Remove multiples of 360°.
Assumed longitude	*Long* =	° ′		West longitudes are negative.
LHA = *GHA* + *Long*	*LHA* =	°		Remove multiples of 360°.
2. Reduction table, 1st entry				
(*Lat*, *LHA*) = (°, °)	*A* =	° ′	*A*° = °	nearest whole degree of *A*.
record *A*, *B* and Z_1.			*A*′ = ′	minutes part of *A*.
	B =	° ′		*B* is minus if 90° < *LHA* < 270°.
			Z_1 = °	Z_1 has the same sign as *B*.
3. From step 1	*Dec* =	° ′		*Dec* is minus if contrary to *Lat*.
F = *B* + *Dec*	*F* =	° ′		Regard *F* as positive until step 7.
			F° = °	nearest whole degree of *F*.
			F′ = ′	minutes part of *F*.
4. Reduction table, 2nd entry				
(*A*°, *F*°) = (°, °)	*H* =	° ′	*P*° = °	nearest whole degree of *P*.
record *H*, *P* and Z_2.			Z_2 = °	
5. Auxiliary table, 1st entry				
(*F*′, *P*°) = (′, °)	$corr_1$ =	′		$corr_1$ is minus if *F* < 90° & *F*′ > 29′,
record $corr_1$				or if *F* > 90° & *F*′ < 30′.
6. Auxiliary table, 2nd entry				Z_2° nearest whole degree of Z_2.
(*A*′, Z_2°) = (′, °)	$corr_2$ =	′		$corr_2$ is minus if *A*′ < 30′.
record $corr_2$				
7. Calculated altitude =	H_C =	° ′		H_C is minus if *F* is negative, and
H_C = *H* + $corr_1$ + $corr_2$				object is below the horizon.
8. Azimuth, 1st component	Z_1 =	°		Z_1 has the same sign as *B*.
2nd component	Z_2 =	°		Z_2 is minus if *F* > 90°. If *F* is negative, Z_2 = 180° − Z_2
$Z = Z_1 + Z_2$	*Z* =	°		Ignore the sign of *Z*.
			N *Lat*:	If *LHA* > 180°, Z_n = *Z*, or if *LHA* < 180°, Z_n = 360° − *Z*,
			S *Lat*:	If *LHA* > 180°, Z_n = 180° − *Z*, or if *LHA* < 180°, Z_n = 180° + *Z*.
True azimuth	Z_n =	°		

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For use with *The Nautical Almanac's* Concise Sight Reduction Tables pages 284-318.

CONVERSION OF ARC TO TIME

0°–59°			60°–119°			120°–179°			180°–239°			240°–299°			300°–359°		
°	h	m	°	h	m	°	h	m	°	h	m	°	h	m	°	h	m
0	0	00	60	4	00	120	8	00	180	12	00	240	16	00	300	20	00
1	0	04	61	4	04	121	8	04	181	12	04	241	16	04	301	20	04
2	0	08	62	4	08	122	8	08	182	12	08	242	16	08	302	20	08
3	0	12	63	4	12	123	8	12	183	12	12	243	16	12	303	20	12
4	0	16	64	4	16	124	8	16	184	12	16	244	16	16	304	20	16
5	0	20	65	4	20	125	8	20	185	12	20	245	16	20	305	20	20
6	0	24	66	4	24	126	8	24	186	12	24	246	16	24	306	20	24
7	0	28	67	4	28	127	8	28	187	12	28	247	16	28	307	20	28
8	0	32	68	4	32	128	8	32	188	12	32	248	16	32	308	20	32
9	0	36	69	4	36	129	8	36	189	12	36	249	16	36	309	20	36
10	0	40	70	4	40	130	8	40	190	12	40	250	16	40	310	20	40
11	0	44	71	4	44	131	8	44	191	12	44	251	16	44	311	20	44
12	0	48	72	4	48	132	8	48	192	12	48	252	16	48	312	20	48
13	0	52	73	4	52	133	8	52	193	12	52	253	16	52	313	20	52
14	0	56	74	4	56	134	8	56	194	12	56	254	16	56	314	20	56
15	1	00	75	5	00	135	9	00	195	13	00	255	17	00	315	21	00
16	1	04	76	5	04	136	9	04	196	13	04	256	17	04	316	21	04
17	1	08	77	5	08	137	9	08	197	13	08	257	17	08	317	21	08
18	1	12	78	5	12	138	9	12	198	13	12	258	17	12	318	21	12
19	1	16	79	5	16	139	9	16	199	13	16	259	17	16	319	21	16
20	1	20	80	5	20	140	9	20	200	13	20	260	17	20	320	21	20
21	1	24	81	5	24	141	9	24	201	13	24	261	17	24	321	21	24
22	1	28	82	5	28	142	9	28	202	13	28	262	17	28	322	21	28
23	1	32	83	5	32	143	9	32	203	13	32	263	17	32	323	21	32
24	1	36	84	5	36	144	9	36	204	13	36	264	17	36	324	21	36
25	1	40	85	5	40	145	9	40	205	13	40	265	17	40	325	21	40
26	1	44	86	5	44	146	9	44	206	13	44	266	17	44	326	21	44
27	1	48	87	5	48	147	9	48	207	13	48	267	17	48	327	21	48
28	1	52	88	5	52	148	9	52	208	13	52	268	17	52	328	21	52
29	1	56	89	5	56	149	9	56	209	13	56	269	17	56	329	21	56
30	2	00	90	6	00	150	10	00	210	14	00	270	18	00	330	22	00
31	2	04	91	6	04	151	10	04	211	14	04	271	18	04	331	22	04
32	2	08	92	6	08	152	10	08	212	14	08	272	18	08	332	22	08
33	2	12	93	6	12	153	10	12	213	14	12	273	18	12	333	22	12
34	2	16	94	6	16	154	10	16	214	14	16	274	18	16	334	22	16
35	2	20	95	6	20	155	10	20	215	14	20	275	18	20	335	22	20
36	2	24	96	6	24	156	10	24	216	14	24	276	18	24	336	22	24
37	2	28	97	6	28	157	10	28	217	14	28	277	18	28	337	22	28
38	2	32	98	6	32	158	10	32	218	14	32	278	18	32	338	22	32
39	2	36	99	6	36	159	10	36	219	14	36	279	18	36	339	22	36
40	2	40	100	6	40	160	10	40	220	14	40	280	18	40	340	22	40
41	2	44	101	6	44	161	10	44	221	14	44	281	18	44	341	22	44
42	2	48	102	6	48	162	10	48	222	14	48	282	18	48	342	22	48
43	2	52	103	6	52	163	10	52	223	14	52	283	18	52	343	22	52
44	2	56	104	6	56	164	10	56	224	14	56	284	18	56	344	22	56
45	3	00	105	7	00	165	11	00	225	15	00	285	19	00	345	23	00
46	3	04	106	7	04	166	11	04	226	15	04	286	19	04	346	23	04
47	3	08	107	7	08	167	11	08	227	15	08	287	19	08	347	23	08
48	3	12	108	7	12	168	11	12	228	15	12	288	19	12	348	23	12
49	3	16	109	7	16	169	11	16	229	15	16	289	19	16	349	23	16
50	3	20	110	7	20	170	11	20	230	15	20	290	19	20	350	23	20
51	3	24	111	7	24	171	11	24	231	15	24	291	19	24	351	23	24
52	3	28	112	7	28	172	11	28	232	15	28	292	19	28	352	23	28
53	3	32	113	7	32	173	11	32	233	15	32	293	19	32	353	23	32
54	3	36	114	7	36	174	11	36	234	15	36	294	19	36	354	23	36
55	3	40	115	7	40	175	11	40	235	15	40	295	19	40	355	23	40
56	3	44	116	7	44	176	11	44	236	15	44	296	19	44	356	23	44
57	3	48	117	7	48	177	11	48	237	15	48	297	19	48	357	23	48
58	3	52	118	7	52	178	11	52	238	15	52	298	19	52	358	23	52
59	3	56	119	7	56	179	11	56	239	15	56	299	19	56	359	23	56

	0′·00		0′·25		0′·50		0′·75	
′	m	s	m	s	m	s	m	s
0	0	00	0	01	0	02	0	03
1	0	04	0	05	0	06	0	07
2	0	08	0	09	0	10	0	11
3	0	12	0	13	0	14	0	15
4	0	16	0	17	0	18	0	19
5	0	20	0	21	0	22	0	23
6	0	24	0	25	0	26	0	27
7	0	28	0	29	0	30	0	31
8	0	32	0	33	0	34	0	35
9	0	36	0	37	0	38	0	39
10	0	40	0	41	0	42	0	43
11	0	44	0	45	0	46	0	47
12	0	48	0	49	0	50	0	51
13	0	52	0	53	0	54	0	55
14	0	56	0	57	0	58	0	59
15	1	00	1	01	1	02	1	03
16	1	04	1	05	1	06	1	07
17	1	08	1	09	1	10	1	11
18	1	12	1	13	1	14	1	15
19	1	16	1	17	1	18	1	19
20	1	20	1	21	1	22	1	23
21	1	24	1	25	1	26	1	27
22	1	28	1	29	1	30	1	31
23	1	32	1	33	1	34	1	35
24	1	36	1	37	1	38	1	39
25	1	40	1	41	1	42	1	43
26	1	44	1	45	1	46	1	47
27	1	48	1	49	1	50	1	51
28	1	52	1	53	1	54	1	55
29	1	56	1	57	1	58	1	59
30	2	00	2	01	2	02	2	03
31	2	04	2	05	2	06	2	07
32	2	08	2	09	2	10	2	11
33	2	12	2	13	2	14	2	15
34	2	16	2	17	2	18	2	19
35	2	20	2	21	2	22	2	23
36	2	24	2	25	2	26	2	27
37	2	28	2	29	2	30	2	31
38	2	32	2	33	2	34	2	35
39	2	36	2	37	2	38	2	39
40	2	40	2	41	2	42	2	43
41	2	44	2	45	2	46	2	47
42	2	48	2	49	2	50	2	51
43	2	52	2	53	2	54	2	55
44	2	56	2	57	2	58	2	59
45	3	00	3	01	3	02	3	03
46	3	04	3	05	3	06	3	07
47	3	08	3	09	3	10	3	11
48	3	12	3	13	3	14	3	15
49	3	16	3	17	3	18	3	19
50	3	20	3	21	3	22	3	23
51	3	24	3	25	3	26	3	27
52	3	28	3	29	3	30	3	31
53	3	32	3	33	3	34	3	35
54	3	36	3	37	3	38	3	39
55	3	40	3	41	3	42	3	43
56	3	44	3	45	3	46	3	47
57	3	48	3	49	3	50	3	51
58	3	52	3	53	3	54	3	55
59	3	56	3	57	3	58	3	59

The above table is for converting expressions in arc to their equivalent in time; its main use in this Almanac is for the conversion of longitude for application to LMT (*added* if *west*, *subtracted* if *east*) to give UT or vice versa, particularly in the case of sunrise, sunset, etc.

m 0	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	0 00·0	0 00·0	0 00·0	0·0	0·0	6·0	0·1	12·0	0·1
01	0 00·3	0 00·3	0 00·2	0·1	0·0	6·1	0·1	12·1	0·1
02	0 00·5	0 00·5	0 00·5	0·2	0·0	6·2	0·1	12·2	0·1
03	0 00·8	0 00·8	0 00·7	0·3	0·0	6·3	0·1	12·3	0·1
04	0 01·0	0 01·0	0 01·0	0·4	0·0	6·4	0·1	12·4	0·1
05	0 01·3	0 01·3	0 01·2	0·5	0·0	6·5	0·1	12·5	0·1
06	0 01·5	0 01·5	0 01·4	0·6	0·0	6·6	0·1	12·6	0·1
07	0 01·8	0 01·8	0 01·7	0·7	0·0	6·7	0·1	12·7	0·1
08	0 02·0	0 02·0	0 01·9	0·8	0·0	6·8	0·1	12·8	0·1
09	0 02·3	0 02·3	0 02·1	0·9	0·0	6·9	0·1	12·9	0·1
10	0 02·5	0 02·5	0 02·4	1·0	0·0	7·0	0·1	13·0	0·1
11	0 02·8	0 02·8	0 02·6	1·1	0·0	7·1	0·1	13·1	0·1
12	0 03·0	0 03·0	0 02·9	1·2	0·0	7·2	0·1	13·2	0·1
13	0 03·3	0 03·3	0 03·1	1·3	0·0	7·3	0·1	13·3	0·1
14	0 03·5	0 03·5	0 03·3	1·4	0·0	7·4	0·1	13·4	0·1
15	0 03·8	0 03·8	0 03·6	1·5	0·0	7·5	0·1	13·5	0·1
16	0 04·0	0 04·0	0 03·8	1·6	0·0	7·6	0·1	13·6	0·1
17	0 04·3	0 04·3	0 04·1	1·7	0·0	7·7	0·1	13·7	0·1
18	0 04·5	0 04·5	0 04·3	1·8	0·0	7·8	0·1	13·8	0·1
19	0 04·8	0 04·8	0 04·5	1·9	0·0	7·9	0·1	13·9	0·1
20	0 05·0	0 05·0	0 04·8	2·0	0·0	8·0	0·1	14·0	0·1
21	0 05·3	0 05·3	0 05·0	2·1	0·0	8·1	0·1	14·1	0·1
22	0 05·5	0 05·5	0 05·2	2·2	0·0	8·2	0·1	14·2	0·1
23	0 05·8	0 05·8	0 05·5	2·3	0·0	8·3	0·1	14·3	0·1
24	0 06·0	0 06·0	0 05·7	2·4	0·0	8·4	0·1	14·4	0·1
25	0 06·3	0 06·3	0 06·0	2·5	0·0	8·5	0·1	14·5	0·1
26	0 06·5	0 06·5	0 06·2	2·6	0·0	8·6	0·1	14·6	0·1
27	0 06·8	0 06·8	0 06·4	2·7	0·0	8·7	0·1	14·7	0·1
28	0 07·0	0 07·0	0 06·7	2·8	0·0	8·8	0·1	14·8	0·1
29	0 07·3	0 07·3	0 06·9	2·9	0·0	8·9	0·1	14·9	0·1
30	0 07·5	0 07·5	0 07·2	3·0	0·0	9·0	0·1	15·0	0·1
31	0 07·8	0 07·8	0 07·4	3·1	0·0	9·1	0·1	15·1	0·1
32	0 08·0	0 08·0	0 07·6	3·2	0·0	9·2	0·1	15·2	0·1
33	0 08·3	0 08·3	0 07·9	3·3	0·0	9·3	0·1	15·3	0·1
34	0 08·5	0 08·5	0 08·1	3·4	0·0	9·4	0·1	15·4	0·1
35	0 08·8	0 08·8	0 08·4	3·5	0·0	9·5	0·1	15·5	0·1
36	0 09·0	0 09·0	0 08·6	3·6	0·0	9·6	0·1	15·6	0·1
37	0 09·3	0 09·3	0 08·8	3·7	0·0	9·7	0·1	15·7	0·1
38	0 09·5	0 09·5	0 09·1	3·8	0·0	9·8	0·1	15·8	0·1
39	0 09·8	0 09·8	0 09·3	3·9	0·0	9·9	0·1	15·9	0·1
40	0 10·0	0 10·0	0 09·5	4·0	0·0	10·0	0·1	16·0	0·1
41	0 10·3	0 10·3	0 09·8	4·1	0·0	10·1	0·1	16·1	0·1
42	0 10·5	0 10·5	0 10·0	4·2	0·0	10·2	0·1	16·2	0·1
43	0 10·8	0 10·8	0 10·3	4·3	0·0	10·3	0·1	16·3	0·1
44	0 11·0	0 11·0	0 10·5	4·4	0·0	10·4	0·1	16·4	0·1
45	0 11·3	0 11·3	0 10·7	4·5	0·0	10·5	0·1	16·5	0·1
46	0 11·5	0 11·5	0 11·0	4·6	0·0	10·6	0·1	16·6	0·1
47	0 11·8	0 11·8	0 11·2	4·7	0·0	10·7	0·1	16·7	0·1
48	0 12·0	0 12·0	0 11·5	4·8	0·0	10·8	0·1	16·8	0·1
49	0 12·3	0 12·3	0 11·7	4·9	0·0	10·9	0·1	16·9	0·1
50	0 12·5	0 12·5	0 11·9	5·0	0·0	11·0	0·1	17·0	0·1
51	0 12·8	0 12·8	0 12·2	5·1	0·0	11·1	0·1	17·1	0·1
52	0 13·0	0 13·0	0 12·4	5·2	0·0	11·2	0·1	17·2	0·1
53	0 13·3	0 13·3	0 12·6	5·3	0·0	11·3	0·1	17·3	0·1
54	0 13·5	0 13·5	0 12·9	5·4	0·0	11·4	0·1	17·4	0·1
55	0 13·8	0 13·8	0 13·1	5·5	0·0	11·5	0·1	17·5	0·1
56	0 14·0	0 14·0	0 13·4	5·6	0·0	11·6	0·1	17·6	0·1
57	0 14·3	0 14·3	0 13·6	5·7	0·0	11·7	0·1	17·7	0·1
58	0 14·5	0 14·5	0 13·8	5·8	0·0	11·8	0·1	17·8	0·1
59	0 14·8	0 14·8	0 14·1	5·9	0·0	11·9	0·1	17·9	0·1
60	0 15·0	0 15·0	0 14·3	6·0	0·1	12·0	0·1	18·0	0·2

m 1	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	0 15·0	0 15·0	0 14·3	0·0	0·0	6·0	0·2	12·0	0·3
01	0 15·3	0 15·3	0 14·6	0·1	0·0	6·1	0·2	12·1	0·3
02	0 15·5	0 15·5	0 14·8	0·2	0·0	6·2	0·2	12·2	0·3
03	0 15·8	0 15·8	0 15·0	0·3	0·0	6·3	0·2	12·3	0·3
04	0 16·0	0 16·0	0 15·3	0·4	0·0	6·4	0·2	12·4	0·3
05	0 16·3	0 16·3	0 15·5	0·5	0·0	6·5	0·2	12·5	0·3
06	0 16·5	0 16·5	0 15·7	0·6	0·0	6·6	0·2	12·6	0·3
07	0 16·8	0 16·8	0 16·0	0·7	0·0	6·7	0·2	12·7	0·3
08	0 17·0	0 17·0	0 16·2	0·8	0·0	6·8	0·2	12·8	0·3
09	0 17·3	0 17·3	0 16·5	0·9	0·0	6·9	0·2	12·9	0·3
10	0 17·5	0 17·5	0 16·7	1·0	0·0	7·0	0·2	13·0	0·3
11	0 17·8	0 17·8	0 16·9	1·1	0·0	7·1	0·2	13·1	0·3
12	0 18·0	0 18·0	0 17·2	1·2	0·0	7·2	0·2	13·2	0·3
13	0 18·3	0 18·3	0 17·4	1·3	0·0	7·3	0·2	13·3	0·3
14	0 18·5	0 18·6	0 17·7	1·4	0·0	7·4	0·2	13·4	0·3
15	0 18·8	0 18·8	0 17·9	1·5	0·0	7·5	0·2	13·5	0·3
16	0 19·0	0 19·1	0 18·1	1·6	0·0	7·6	0·2	13·6	0·3
17	0 19·3	0 19·3	0 18·4	1·7	0·0	7·7	0·2	13·7	0·3
18	0 19·5	0 19·6	0 18·6	1·8	0·0	7·8	0·2	13·8	0·3
19	0 19·8	0 19·8	0 18·9	1·9	0·0	7·9	0·2	13·9	0·3
20	0 20·0	0 20·1	0 19·1	2·0	0·1	8·0	0·2	14·0	0·4
21	0 20·3	0 20·3	0 19·3	2·1	0·1	8·1	0·2	14·1	0·4
22	0 20·5	0 20·6	0 19·6	2·2	0·1	8·2	0·2	14·2	0·4
23	0 20·8	0 20·8	0 19·8	2·3	0·1	8·3	0·2	14·3	0·4
24	0 21·0	0 21·1	0 20·0	2·4	0·1	8·4	0·2	14·4	0·4
25	0 21·3	0 21·3	0 20·3	2·5	0·1	8·5	0·2	14·5	0·4
26	0 21·5	0 21·6	0 20·5	2·6	0·1	8·6	0·2	14·6	0·4
27	0 21·8	0 21·8	0 20·8	2·7	0·1	8·7	0·2	14·7	0·4
28	0 22·0	0 22·1	0 21·0	2·8	0·1	8·8	0·2	14·8	0·4
29	0 22·3	0 22·3	0 21·2	2·9	0·1	8·9	0·2	14·9	0·4
30	0 22·5	0 22·6	0 21·5	3·0	0·1	9·0	0·2	15·0	0·4
31	0 22·8	0 22·8	0 21·7	3·1	0·1	9·1	0·2	15·1	0·4
32	0 23·0	0 23·1	0 22·0	3·2	0·1	9·2	0·2	15·2	0·4
33	0 23·3	0 23·3	0 22·2	3·3	0·1	9·3	0·2	15·3	0·4
34	0 23·5	0 23·6	0 22·4	3·4	0·1	9·4	0·2	15·4	0·4
35	0 23·8	0 23·8	0 22·7	3·5	0·1	9·5	0·2	15·5	0·4
36	0 24·0	0 24·1	0 22·9	3·6	0·1	9·6	0·2	15·6	0·4
37	0 24·3	0 24·3	0 23·1	3·7	0·1	9·7	0·2	15·7	0·4
38	0 24·5	0 24·6	0 23·4	3·8	0·1	9·8	0·2	15·8	0·4
39	0 24·8	0 24·8	0 23·6	3·9	0·1	9·9	0·2	15·9	0·4
40	0 25·0	0 25·1	0 23·9	4·0	0·1	10·0	0·3	16·0	0·4
41	0 25·3	0 25·3	0 24·1	4·1	0·1	10·1	0·3	16·1	0·4
42	0 25·5	0 25·6	0 24·3	4·2	0·1	10·2	0·3	16·2	0·4
43	0 25·8	0 25·8	0 24·6	4·3	0·1	10·3	0·3	16·3	0·4
44	0 26·0	0 26·1	0 24·8	4·4	0·1	10·4	0·3	16·4	0·4
45	0 26·3	0 26·3	0 25·1	4·5	0·1	10·5	0·3	16·5	0·4
46	0 26·5	0 26·6	0 25·3	4·6	0·1	10·6	0·3	16·6	0·4
47	0 26·8	0 26·8	0 25·5	4·7	0·1	10·7	0·3	16·7	0·4
48	0 27·0	0 27·1	0 25·8	4·8	0·1	10·8	0·3	16·8	0·4
49	0 27·3	0 27·3	0 26·0	4·9	0·1	10·9	0·3	16·9	0·4
50	0 27·5	0 27·6	0 26·2	5·0	0·1	11·0	0·3	17·0	0·4
51	0 27·8	0 27·8	0 26·5	5·1	0·1	11·1	0·3	17·1	0·4
52	0 28·0	0 28·1	0 26·7	5·2	0·1	11·2	0·3	17·2	0·4
53	0 28·3	0 28·3	0 27·0	5·3	0·1	11·3	0·3	17·3	0·4
54	0 28·5	0 28·6	0 27·2	5·4	0·1	11·4	0·3	17·4	0·4
55	0 28·8	0 28·8	0 27·4	5·5	0·1	11·5	0·3	17·5	0·4
56	0 29·0	0 29·1	0 27·7	5·6	0·1	11·6	0·3	17·6	0·4
57	0 29·3	0 29·3	0 27·9	5·7	0·1	11·7	0·3	17·7	0·4
58	0 29·5	0 29·6	0 28·2	5·8	0·1	11·8	0·3	17·8	0·4
59	0 29·8	0 29·8	0 28·4	5·9	0·1	11·9	0·3	17·9	0·4
60	0 30·0	0 30·1	0 28·6	6·0	0·2	12·0	0·3	18·0	0·5

m 2	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	0 30·0	0 30·1	0 28·6	0·0	0·0	6·0	0·3	12·0	0·5
01	0 30·3	0 30·3	0 28·9	0·1	0·0	6·1	0·3	12·1	0·5
02	0 30·5	0 30·6	0 29·1	0·2	0·0	6·2	0·3	12·2	0·5
03	0 30·8	0 30·8	0 29·3	0·3	0·0	6·3	0·3	12·3	0·5
04	0 31·0	0 31·1	0 29·6	0·4	0·0	6·4	0·3	12·4	0·5
05	0 31·3	0 31·3	0 29·8	0·5	0·0	6·5	0·3	12·5	0·5
06	0 31·5	0 31·6	0 30·1	0·6	0·0	6·6	0·3	12·6	0·5
07	0 31·8	0 31·8	0 30·3	0·7	0·0	6·7	0·3	12·7	0·5
08	0 32·0	0 32·1	0 30·5	0·8	0·0	6·8	0·3	12·8	0·5
09	0 32·3	0 32·3	0 30·8	0·9	0·0	6·9	0·3	12·9	0·5
10	0 32·5	0 32·6	0 31·0	1·0	0·0	7·0	0·3	13·0	0·5
11	0 32·8	0 32·8	0 31·3	1·1	0·0	7·1	0·3	13·1	0·5
12	0 33·0	0 33·1	0 31·5	1·2	0·1	7·2	0·3	13·2	0·6
13	0 33·3	0 33·3	0 31·7	1·3	0·1	7·3	0·3	13·3	0·6
14	0 33·5	0 33·6	0 32·0	1·4	0·1	7·4	0·3	13·4	0·6
15	0 33·8	0 33·8	0 32·2	1·5	0·1	7·5	0·3	13·5	0·6
16	0 34·0	0 34·1	0 32·5	1·6	0·1	7·6	0·3	13·6	0·6
17	0 34·3	0 34·3	0 32·7	1·7	0·1	7·7	0·3	13·7	0·6
18	0 34·5	0 34·6	0 32·9	1·8	0·1	7·8	0·3	13·8	0·6
19	0 34·8	0 34·8	0 33·2	1·9	0·1	7·9	0·3	13·9	0·6
20	0 35·0	0 35·1	0 33·4	2·0	0·1	8·0	0·3	14·0	0·6
21	0 35·3	0 35·3	0 33·6	2·1	0·1	8·1	0·3	14·1	0·6
22	0 35·5	0 35·6	0 33·9	2·2	0·1	8·2	0·3	14·2	0·6
23	0 35·8	0 35·8	0 34·1	2·3	0·1	8·3	0·3	14·3	0·6
24	0 36·0	0 36·1	0 34·4	2·4	0·1	8·4	0·4	14·4	0·6
25	0 36·3	0 36·3	0 34·6	2·5	0·1	8·5	0·4	14·5	0·6
26	0 36·5	0 36·6	0 34·8	2·6	0·1	8·6	0·4	14·6	0·6
27	0 36·8	0 36·9	0 35·1	2·7	0·1	8·7	0·4	14·7	0·6
28	0 37·0	0 37·1	0 35·3	2·8	0·1	8·8	0·4	14·8	0·6
29	0 37·3	0 37·4	0 35·6	2·9	0·1	8·9	0·4	14·9	0·6
30	0 37·5	0 37·6	0 35·8	3·0	0·1	9·0	0·4	15·0	0·6
31	0 37·8	0 37·9	0 36·0	3·1	0·1	9·1	0·4	15·1	0·6
32	0 38·0	0 38·1	0 36·3	3·2	0·1	9·2	0·4	15·2	0·6
33	0 38·3	0 38·4	0 36·5	3·3	0·1	9·3	0·4	15·3	0·6
34	0 38·5	0 38·6	0 36·7	3·4	0·1	9·4	0·4	15·4	0·6
35	0 38·8	0 38·9	0 37·0	3·5	0·1	9·5	0·4	15·5	0·6
36	0 39·0	0 39·1	0 37·2	3·6	0·2	9·6	0·4	15·6	0·7
37	0 39·3	0 39·4	0 37·5	3·7	0·2	9·7	0·4	15·7	0·7
38	0 39·5	0 39·6	0 37·7	3·8	0·2	9·8	0·4	15·8	0·7
39	0 39·8	0 39·9	0 37·9	3·9	0·2	9·9	0·4	15·9	0·7
40	0 40·0	0 40·1	0 38·2	4·0	0·2	10·0	0·4	16·0	0·7
41	0 40·3	0 40·4	0 38·4	4·1	0·2	10·1	0·4	16·1	0·7
42	0 40·5	0 40·6	0 38·7	4·2	0·2	10·2	0·4	16·2	0·7
43	0 40·8	0 40·9	0 38·9	4·3	0·2	10·3	0·4	16·3	0·7
44	0 41·0	0 41·1	0 39·1	4·4	0·2	10·4	0·4	16·4	0·7
45	0 41·3	0 41·4	0 39·4	4·5	0·2	10·5	0·4	16·5	0·7
46	0 41·5	0 41·6	0 39·6	4·6	0·2	10·6	0·4	16·6	0·7
47	0 41·8	0 41·9	0 39·8	4·7	0·2	10·7	0·4	16·7	0·7
48	0 42·0	0 42·1	0 40·1	4·8	0·2	10·8	0·5	16·8	0·7
49	0 42·3	0 42·4	0 40·3	4·9	0·2	10·9	0·5	16·9	0·7
50	0 42·5	0 42·6	0 40·6	5·0	0·2	11·0	0·5	17·0	0·7
51	0 42·8	0 42·9	0 40·8	5·1	0·2	11·1	0·5	17·1	0·7
52	0 43·0	0 43·1	0 41·0	5·2	0·2	11·2	0·5	17·2	0·7
53	0 43·3	0 43·4	0 41·3	5·3	0·2	11·3	0·5	17·3	0·7
54	0 43·5	0 43·6	0 41·5	5·4	0·2	11·4	0·5	17·4	0·7
55	0 43·8	0 43·9	0 41·8	5·5	0·2	11·5	0·5	17·5	0·7
56	0 44·0	0 44·1	0 42·0	5·6	0·2	11·6	0·5	17·6	0·7
57	0 44·3	0 44·4	0 42·2	5·7	0·2	11·7	0·5	17·7	0·7
58	0 44·5	0 44·6	0 42·5	5·8	0·2	11·8	0·5	17·8	0·7
59	0 44·8	0 44·9	0 42·7	5·9	0·2	11·9	0·5	17·9	0·7
60	0 45·0	0 45·1	0 43·0	6·0	0·3	12·0	0·5	18·0	0·8

m 3	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	0 45·0	0 45·1	0 43·0	0·0	0·0	6·0	0·4	12·0	0·7
01	0 45·3	0 45·4	0 43·2	0·1	0·0	6·1	0·4	12·1	0·7
02	0 45·5	0 45·6	0 43·4	0·2	0·0	6·2	0·4	12·2	0·7
03	0 45·8	0 45·9	0 43·7	0·3	0·0	6·3	0·4	12·3	0·7
04	0 46·0	0 46·1	0 43·9	0·4	0·0	6·4	0·4	12·4	0·7
05	0 46·3	0 46·4	0 44·1	0·5	0·0	6·5	0·4	12·5	0·7
06	0 46·5	0 46·6	0 44·4	0·6	0·0	6·6	0·4	12·6	0·7
07	0 46·8	0 46·9	0 44·6	0·7	0·0	6·7	0·4	12·7	0·7
08	0 47·0	0 47·1	0 44·9	0·8	0·0	6·8	0·4	12·8	0·7
09	0 47·3	0 47·4	0 45·1	0·9	0·1	6·9	0·4	12·9	0·8
10	0 47·5	0 47·6	0 45·3	1·0	0·1	7·0	0·4	13·0	0·8
11	0 47·8	0 47·9	0 45·6	1·1	0·1	7·1	0·4	13·1	0·8
12	0 48·0	0 48·1	0 45·8	1·2	0·1	7·2	0·4	13·2	0·8
13	0 48·3	0 48·4	0 46·1	1·3	0·1	7·3	0·4	13·3	0·8
14	0 48·5	0 48·6	0 46·3	1·4	0·1	7·4	0·4	13·4	0·8
15	0 48·8	0 48·9	0 46·5	1·5	0·1	7·5	0·4	13·5	0·8
16	0 49·0	0 49·1	0 46·8	1·6	0·1	7·6	0·4	13·6	0·8
17	0 49·3	0 49·4	0 47·0	1·7	0·1	7·7	0·4	13·7	0·8
18	0 49·5	0 49·6	0 47·2	1·8	0·1	7·8	0·5	13·8	0·8
19	0 49·8	0 49·9	0 47·5	1·9	0·1	7·9	0·5	13·9	0·8
20	0 50·0	0 50·1	0 47·7	2·0	0·1	8·0	0·5	14·0	0·8
21	0 50·3	0 50·4	0 48·0	2·1	0·1	8·1	0·5	14·1	0·8
22	0 50·5	0 50·6	0 48·2	2·2	0·1	8·2	0·5	14·2	0·8
23	0 50·8	0 50·9	0 48·4	2·3	0·1	8·3	0·5	14·3	0·8
24	0 51·0	0 51·1	0 48·7	2·4	0·1	8·4	0·5	14·4	0·8
25	0 51·3	0 51·4	0 48·9	2·5	0·1	8·5	0·5	14·5	0·8
26	0 51·5	0 51·6	0 49·2	2·6	0·2	8·6	0·5	14·6	0·9
27	0 51·8	0 51·9	0 49·4	2·7	0·2	8·7	0·5	14·7	0·9
28	0 52·0	0 52·1	0 49·6	2·8	0·2	8·8	0·5	14·8	0·9
29	0 52·3	0 52·4	0 49·9	2·9	0·2	8·9	0·5	14·9	0·9
30	0 52·5	0 52·6	0 50·1	3·0	0·2	9·0	0·5	15·0	0·9
31	0 52·8	0 52·9	0 50·3	3·1	0·2	9·1	0·5	15·1	0·9
32	0 53·0	0 53·1	0 50·6	3·2	0·2	9·2	0·5	15·2	0·9
33	0 53·3	0 53·4	0 50·8	3·3	0·2	9·3	0·5	15·3	0·9
34	0 53·5	0 53·6	0 51·1	3·4	0·2	9·4	0·5	15·4	0·9
35	0 53·8	0 53·9	0 51·3	3·5	0·2	9·5	0·6	15·5	0·9
36	0 54·0	0 54·1	0 51·5	3·6	0·2	9·6	0·6	15·6	0·9
37	0 54·3	0 54·4	0 51·8	3·7	0·2	9·7	0·6	15·7	0·9
38	0 54·5	0 54·6	0 52·0	3·8	0·2	9·8	0·6	15·8	0·9
39	0 54·8	0 54·9	0 52·3	3·9	0·2	9·9	0·6	15·9	0·9
40	0 55·0	0 55·2	0 52·5	4·0	0·2	10·0	0·6	16·0	0·9
41	0 55·3	0 55·4	0 52·7	4·1	0·2	10·1	0·6	16·1	0·9
42	0 55·5	0 55·7	0 53·0	4·2	0·2	10·2	0·6	16·2	0·9
43	0 55·8	0 55·9	0 53·2	4·3	0·3	10·3	0·6	16·3	1·0
44	0 56·0	0 56·2	0 53·4	4·4	0·3	10·4	0·6	16·4	1·0
45	0 56·3	0 56·4	0 53·7	4·5	0·3	10·5	0·6	16·5	1·0
46	0 56·5	0 56·7	0 53·9	4·6	0·3	10·6	0·6	16·6	1·0
47	0 56·8	0 56·9	0 54·2	4·7	0·3	10·7	0·6	16·7	1·0
48	0 57·0	0 57·2	0 54·4	4·8	0·3	10·8	0·6	16·8	1·0
49	0 57·3	0 57·4	0 54·6	4·9	0·3	10·9	0·6	16·9	1·0
50	0 57·5	0 57·7	0 54·9	5·0	0·3	11·0	0·6	17·0	1·0
51	0 57·8	0 57·9	0 55·1	5·1	0·3	11·1	0·6	17·1	1·0
52	0 58·0	0 58·2	0 55·4	5·2	0·3	11·2	0·7	17·2	1·0
53	0 58·3	0 58·4	0 55·6	5·3	0·3	11·3	0·7	17·3	1·0
54	0 58·5	0 58·7	0 55·8	5·4	0·3	11·4	0·7	17·4	1·0
55	0 58·8	0 58·9	0 56·1	5·5	0·3	11·5	0·7	17·5	1·0
56	0 59·0	0 59·2	0 56·3	5·6	0·3	11·6	0·7	17·6	1·0
57	0 59·3	0 59·4	0 56·6	5·7	0·3	11·7	0·7	17·7	1·0
58	0 59·5	0 59·7	0 56·8	5·8	0·3	11·8	0·7	17·8	1·0
59	0 59·8	0 59·9	0 57·0	5·9	0·3	11·9	0·7	17·9	1·0
60	1 00·0	1 00·2	0 57·3	6·0	0·4	12·0	0·7	18·0	1·1

m 4	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	1 00·0	1 00·2	0 57·3	0·0	0·0	6·0	0·5	12·0	0·9
01	1 00·3	1 00·4	0 57·5	0·1	0·0	6·1	0·5	12·1	0·9
02	1 00·5	1 00·7	0 57·7	0·2	0·0	6·2	0·5	12·2	0·9
03	1 00·8	1 00·9	0 58·0	0·3	0·0	6·3	0·5	12·3	0·9
04	1 01·0	1 01·2	0 58·2	0·4	0·0	6·4	0·5	12·4	0·9
05	1 01·3	1 01·4	0 58·5	0·5	0·0	6·5	0·5	12·5	0·9
06	1 01·5	1 01·7	0 58·7	0·6	0·0	6·6	0·5	12·6	0·9
07	1 01·8	1 01·9	0 58·9	0·7	0·1	6·7	0·5	12·7	1·0
08	1 02·0	1 02·2	0 59·2	0·8	0·1	6·8	0·5	12·8	1·0
09	1 02·3	1 02·4	0 59·4	0·9	0·1	6·9	0·5	12·9	1·0
10	1 02·5	1 02·7	0 59·7	1·0	0·1	7·0	0·5	13·0	1·0
11	1 02·8	1 02·9	0 59·9	1·1	0·1	7·1	0·5	13·1	1·0
12	1 03·0	1 03·2	1 00·1	1·2	0·1	7·2	0·5	13·2	1·0
13	1 03·3	1 03·4	1 00·4	1·3	0·1	7·3	0·5	13·3	1·0
14	1 03·5	1 03·7	1 00·6	1·4	0·1	7·4	0·6	13·4	1·0
15	1 03·8	1 03·9	1 00·8	1·5	0·1	7·5	0·6	13·5	1·0
16	1 04·0	1 04·2	1 01·1	1·6	0·1	7·6	0·6	13·6	1·0
17	1 04·3	1 04·4	1 01·3	1·7	0·1	7·7	0·6	13·7	1·0
18	1 04·5	1 04·7	1 01·6	1·8	0·1	7·8	0·6	13·8	1·0
19	1 04·8	1 04·9	1 01·8	1·9	0·1	7·9	0·6	13·9	1·0
20	1 05·0	1 05·2	1 02·0	2·0	0·2	8·0	0·6	14·0	1·1
21	1 05·3	1 05·4	1 02·3	2·1	0·2	8·1	0·6	14·1	1·1
22	1 05·5	1 05·7	1 02·5	2·2	0·2	8·2	0·6	14·2	1·1
23	1 05·8	1 05·9	1 02·8	2·3	0·2	8·3	0·6	14·3	1·1
24	1 06·0	1 06·2	1 03·0	2·4	0·2	8·4	0·6	14·4	1·1
25	1 06·3	1 06·4	1 03·2	2·5	0·2	8·5	0·6	14·5	1·1
26	1 06·5	1 06·7	1 03·5	2·6	0·2	8·6	0·6	14·6	1·1
27	1 06·8	1 06·9	1 03·7	2·7	0·2	8·7	0·7	14·7	1·1
28	1 07·0	1 07·2	1 03·9	2·8	0·2	8·8	0·7	14·8	1·1
29	1 07·3	1 07·4	1 04·2	2·9	0·2	8·9	0·7	14·9	1·1
30	1 07·5	1 07·7	1 04·4	3·0	0·2	9·0	0·7	15·0	1·1
31	1 07·8	1 07·9	1 04·7	3·1	0·2	9·1	0·7	15·1	1·1
32	1 08·0	1 08·2	1 04·9	3·2	0·2	9·2	0·7	15·2	1·1
33	1 08·3	1 08·4	1 05·1	3·3	0·2	9·3	0·7	15·3	1·1
34	1 08·5	1 08·7	1 05·4	3·4	0·3	9·4	0·7	15·4	1·2
35	1 08·8	1 08·9	1 05·6	3·5	0·3	9·5	0·7	15·5	1·2
36	1 09·0	1 09·2	1 05·9	3·6	0·3	9·6	0·7	15·6	1·2
37	1 09·3	1 09·4	1 06·1	3·7	0·3	9·7	0·7	15·7	1·2
38	1 09·5	1 09·7	1 06·3	3·8	0·3	9·8	0·7	15·8	1·2
39	1 09·8	1 09·9	1 06·6	3·9	0·3	9·9	0·7	15·9	1·2
40	1 10·0	1 10·2	1 06·8	4·0	0·3	10·0	0·8	16·0	1·2
41	1 10·3	1 10·4	1 07·0	4·1	0·3	10·1	0·8	16·1	1·2
42	1 10·5	1 10·7	1 07·3	4·2	0·3	10·2	0·8	16·2	1·2
43	1 10·8	1 10·9	1 07·5	4·3	0·3	10·3	0·8	16·3	1·2
44	1 11·0	1 11·2	1 07·8	4·4	0·3	10·4	0·8	16·4	1·2
45	1 11·3	1 11·4	1 08·0	4·5	0·3	10·5	0·8	16·5	1·2
46	1 11·5	1 11·7	1 08·2	4·6	0·3	10·6	0·8	16·6	1·2
47	1 11·8	1 11·9	1 08·5	4·7	0·4	10·7	0·8	16·7	1·3
48	1 12·0	1 12·2	1 08·7	4·8	0·4	10·8	0·8	16·8	1·3
49	1 12·3	1 12·4	1 09·0	4·9	0·4	10·9	0·8	16·9	1·3
50	1 12·5	1 12·7	1 09·2	5·0	0·4	11·0	0·8	17·0	1·3
51	1 12·8	1 12·9	1 09·4	5·1	0·4	11·1	0·8	17·1	1·3
52	1 13·0	1 13·2	1 09·7	5·2	0·4	11·2	0·8	17·2	1·3
53	1 13·3	1 13·5	1 09·9	5·3	0·4	11·3	0·8	17·3	1·3
54	1 13·5	1 13·7	1 10·2	5·4	0·4	11·4	0·9	17·4	1·3
55	1 13·8	1 14·0	1 10·4	5·5	0·4	11·5	0·9	17·5	1·3
56	1 14·0	1 14·2	1 10·6	5·6	0·4	11·6	0·9	17·6	1·3
57	1 14·3	1 14·5	1 10·9	5·7	0·4	11·7	0·9	17·7	1·3
58	1 14·5	1 14·7	1 11·1	5·8	0·4	11·8	0·9	17·8	1·3
59	1 14·8	1 15·0	1 11·3	5·9	0·4	11·9	0·9	17·9	1·3
60	1 15·0	1 15·2	1 11·6	6·0	0·5	12·0	0·9	18·0	1·4

m 5	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	1 15·0	1 15·2	1 11·6	0·0	0·0	6·0	0·6	12·0	1·1
01	1 15·3	1 15·5	1 11·8	0·1	0·0	6·1	0·6	12·1	1·1
02	1 15·5	1 15·7	1 12·1	0·2	0·0	6·2	0·6	12·2	1·1
03	1 15·8	1 16·0	1 12·3	0·3	0·0	6·3	0·6	12·3	1·1
04	1 16·0	1 16·2	1 12·5	0·4	0·0	6·4	0·6	12·4	1·1
05	1 16·3	1 16·5	1 12·8	0·5	0·0	6·5	0·6	12·5	1·1
06	1 16·5	1 16·7	1 13·0	0·6	0·1	6·6	0·6	12·6	1·2
07	1 16·8	1 17·0	1 13·3	0·7	0·1	6·7	0·6	12·7	1·2
08	1 17·0	1 17·2	1 13·5	0·8	0·1	6·8	0·6	12·8	1·2
09	1 17·3	1 17·5	1 13·7	0·9	0·1	6·9	0·6	12·9	1·2
10	1 17·5	1 17·7	1 14·0	1·0	0·1	7·0	0·6	13·0	1·2
11	1 17·8	1 18·0	1 14·2	1·1	0·1	7·1	0·7	13·1	1·2
12	1 18·0	1 18·2	1 14·4	1·2	0·1	7·2	0·7	13·2	1·2
13	1 18·3	1 18·5	1 14·7	1·3	0·1	7·3	0·7	13·3	1·2
14	1 18·5	1 18·7	1 14·9	1·4	0·1	7·4	0·7	13·4	1·2
15	1 18·8	1 19·0	1 15·2	1·5	0·1	7·5	0·7	13·5	1·2
16	1 19·0	1 19·2	1 15·4	1·6	0·1	7·6	0·7	13·6	1·2
17	1 19·3	1 19·5	1 15·6	1·7	0·2	7·7	0·7	13·7	1·3
18	1 19·5	1 19·7	1 15·9	1·8	0·2	7·8	0·7	13·8	1·3
19	1 19·8	1 20·0	1 16·1	1·9	0·2	7·9	0·7	13·9	1·3
20	1 20·0	1 20·2	1 16·4	2·0	0·2	8·0	0·7	14·0	1·3
21	1 20·3	1 20·5	1 16·6	2·1	0·2	8·1	0·7	14·1	1·3
22	1 20·5	1 20·7	1 16·8	2·2	0·2	8·2	0·8	14·2	1·3
23	1 20·8	1 21·0	1 17·1	2·3	0·2	8·3	0·8	14·3	1·3
24	1 21·0	1 21·2	1 17·3	2·4	0·2	8·4	0·8	14·4	1·3
25	1 21·3	1 21·5	1 17·5	2·5	0·2	8·5	0·8	14·5	1·3
26	1 21·5	1 21·7	1 17·8	2·6	0·2	8·6	0·8	14·6	1·3
27	1 21·8	1 22·0	1 18·0	2·7	0·2	8·7	0·8	14·7	1·3
28	1 22·0	1 22·2	1 18·3	2·8	0·3	8·8	0·8	14·8	1·4
29	1 22·3	1 22·5	1 18·5	2·9	0·3	8·9	0·8	14·9	1·4
30	1 22·5	1 22·7	1 18·7	3·0	0·3	9·0	0·8	15·0	1·4
31	1 22·8	1 23·0	1 19·0	3·1	0·3	9·1	0·8	15·1	1·4
32	1 23·0	1 23·2	1 19·2	3·2	0·3	9·2	0·8	15·2	1·4
33	1 23·3	1 23·5	1 19·5	3·3	0·3	9·3	0·9	15·3	1·4
34	1 23·5	1 23·7	1 19·7	3·4	0·3	9·4	0·9	15·4	1·4
35	1 23·8	1 24·0	1 19·9	3·5	0·3	9·5	0·9	15·5	1·4
36	1 24·0	1 24·2	1 20·2	3·6	0·3	9·6	0·9	15·6	1·4
37	1 24·3	1 24·5	1 20·4	3·7	0·3	9·7	0·9	15·7	1·4
38	1 24·5	1 24·7	1 20·7	3·8	0·3	9·8	0·9	15·8	1·4
39	1 24·8	1 25·0	1 20·9	3·9	0·4	9·9	0·9	15·9	1·5
40	1 25·0	1 25·2	1 21·1	4·0	0·4	10·0	0·9	16·0	1·5
41	1 25·3	1 25·5	1 21·4	4·1	0·4	10·1	0·9	16·1	1·5
42	1 25·5	1 25·7	1 21·6	4·2	0·4	10·2	0·9	16·2	1·5
43	1 25·8	1 26·0	1 21·8	4·3	0·4	10·3	0·9	16·3	1·5
44	1 26·0	1 26·2	1 22·1	4·4	0·4	10·4	1·0	16·4	1·5
45	1 26·3	1 26·5	1 22·3	4·5	0·4	10·5	1·0	16·5	1·5
46	1 26·5	1 26·7	1 22·6	4·6	0·4	10·6	1·0	16·6	1·5
47	1 26·8	1 27·0	1 22·8	4·7	0·4	10·7	1·0	16·7	1·5
48	1 27·0	1 27·2	1 23·0	4·8	0·4	10·8	1·0	16·8	1·5
49	1 27·3	1 27·5	1 23·3	4·9	0·4	10·9	1·0	16·9	1·5
50	1 27·5	1 27·7	1 23·5	5·0	0·5	11·0	1·0	17·0	1·6
51	1 27·8	1 28·0	1 23·8	5·1	0·5	11·1	1·0	17·1	1·6
52	1 28·0	1 28·2	1 24·0	5·2	0·5	11·2	1·0	17·2	1·6
53	1 28·3	1 28·5	1 24·2	5·3	0·5	11·3	1·0	17·3	1·6
54	1 28·5	1 28·7	1 24·5	5·4	0·5	11·4	1·0	17·4	1·6
55	1 28·8	1 29·0	1 24·7	5·5	0·5	11·5	1·1	17·5	1·6
56	1 29·0	1 29·2	1 24·9	5·6	0·5	11·6	1·1	17·6	1·6
57	1 29·3	1 29·5	1 25·2	5·7	0·5	11·7	1·1	17·7	1·6
58	1 29·5	1 29·7	1 25·4	5·8	0·5	11·8	1·1	17·8	1·6
59	1 29·8	1 30·0	1 25·7	5·9	0·5	11·9	1·1	17·9	1·6
60	1 30·0	1 30·2	1 25·9	6·0	0·6	12·0	1·1	18·0	1·7

m 6	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	1 30·0	1 30·2	1 25·9	0·0	0·0	6·0	0·7	12·0	1·3
01	1 30·3	1 30·5	1 26·1	0·1	0·0	6·1	0·7	12·1	1·3
02	1 30·5	1 30·7	1 26·4	0·2	0·0	6·2	0·7	12·2	1·3
03	1 30·8	1 31·0	1 26·6	0·3	0·0	6·3	0·7	12·3	1·3
04	1 31·0	1 31·2	1 26·9	0·4	0·0	6·4	0·7	12·4	1·3
05	1 31·3	1 31·5	1 27·1	0·5	0·1	6·5	0·7	12·5	1·4
06	1 31·5	1 31·8	1 27·3	0·6	0·1	6·6	0·7	12·6	1·4
07	1 31·8	1 32·0	1 27·6	0·7	0·1	6·7	0·7	12·7	1·4
08	1 32·0	1 32·3	1 27·8	0·8	0·1	6·8	0·7	12·8	1·4
09	1 32·3	1 32·5	1 28·0	0·9	0·1	6·9	0·7	12·9	1·4
10	1 32·5	1 32·8	1 28·3	1·0	0·1	7·0	0·8	13·0	1·4
11	1 32·8	1 33·0	1 28·5	1·1	0·1	7·1	0·8	13·1	1·4
12	1 33·0	1 33·3	1 28·8	1·2	0·1	7·2	0·8	13·2	1·4
13	1 33·3	1 33·5	1 29·0	1·3	0·1	7·3	0·8	13·3	1·4
14	1 33·5	1 33·8	1 29·2	1·4	0·2	7·4	0·8	13·4	1·5
15	1 33·8	1 34·0	1 29·5	1·5	0·2	7·5	0·8	13·5	1·5
16	1 34·0	1 34·3	1 29·7	1·6	0·2	7·6	0·8	13·6	1·5
17	1 34·3	1 34·5	1 30·0	1·7	0·2	7·7	0·8	13·7	1·5
18	1 34·5	1 34·8	1 30·2	1·8	0·2	7·8	0·8	13·8	1·5
19	1 34·8	1 35·0	1 30·4	1·9	0·2	7·9	0·9	13·9	1·5
20	1 35·0	1 35·3	1 30·7	2·0	0·2	8·0	0·9	14·0	1·5
21	1 35·3	1 35·5	1 30·9	2·1	0·2	8·1	0·9	14·1	1·5
22	1 35·5	1 35·8	1 31·1	2·2	0·2	8·2	0·9	14·2	1·5
23	1 35·8	1 36·0	1 31·4	2·3	0·2	8·3	0·9	14·3	1·5
24	1 36·0	1 36·3	1 31·6	2·4	0·3	8·4	0·9	14·4	1·6
25	1 36·3	1 36·5	1 31·9	2·5	0·3	8·5	0·9	14·5	1·6
26	1 36·5	1 36·8	1 32·1	2·6	0·3	8·6	0·9	14·6	1·6
27	1 36·8	1 37·0	1 32·3	2·7	0·3	8·7	0·9	14·7	1·6
28	1 37·0	1 37·3	1 32·6	2·8	0·3	8·8	1·0	14·8	1·6
29	1 37·3	1 37·5	1 32·8	2·9	0·3	8·9	1·0	14·9	1·6
30	1 37·5	1 37·8	1 33·1	3·0	0·3	9·0	1·0	15·0	1·6
31	1 37·8	1 38·0	1 33·3	3·1	0·3	9·1	1·0	15·1	1·6
32	1 38·0	1 38·3	1 33·5	3·2	0·3	9·2	1·0	15·2	1·6
33	1 38·3	1 38·5	1 33·8	3·3	0·4	9·3	1·0	15·3	1·7
34	1 38·5	1 38·8	1 34·0	3·4	0·4	9·4	1·0	15·4	1·7
35	1 38·8	1 39·0	1 34·3	3·5	0·4	9·5	1·0	15·5	1·7
36	1 39·0	1 39·3	1 34·5	3·6	0·4	9·6	1·0	15·6	1·7
37	1 39·3	1 39·5	1 34·7	3·7	0·4	9·7	1·1	15·7	1·7
38	1 39·5	1 39·8	1 35·0	3·8	0·4	9·8	1·1	15·8	1·7
39	1 39·8	1 40·0	1 35·2	3·9	0·4	9·9	1·1	15·9	1·7
40	1 40·0	1 40·3	1 35·4	4·0	0·4	10·0	1·1	16·0	1·7
41	1 40·3	1 40·5	1 35·7	4·1	0·4	10·1	1·1	16·1	1·7
42	1 40·5	1 40·8	1 35·9	4·2	0·5	10·2	1·1	16·2	1·8
43	1 40·8	1 41·0	1 36·2	4·3	0·5	10·3	1·1	16·3	1·8
44	1 41·0	1 41·3	1 36·4	4·4	0·5	10·4	1·1	16·4	1·8
45	1 41·3	1 41·5	1 36·6	4·5	0·5	10·5	1·1	16·5	1·8
46	1 41·5	1 41·8	1 36·9	4·6	0·5	10·6	1·1	16·6	1·8
47	1 41·8	1 42·0	1 37·1	4·7	0·5	10·7	1·2	16·7	1·8
48	1 42·0	1 42·3	1 37·4	4·8	0·5	10·8	1·2	16·8	1·8
49	1 42·3	1 42·5	1 37·6	4·9	0·5	10·9	1·2	16·9	1·8
50	1 42·5	1 42·8	1 37 8	5·0	0·5	11·0	1·2	17·0	1·8
51	1 42·8	1 43·0	1 38·1	5·1	0·6	11·1	1·2	17·1	1·9
52	1 43·0	1 43·3	1 38·3	5·2	0·6	11·2	1·2	17·2	1·9
53	1 43·3	1 43·5	1 38·5	5·3	0·6	11·3	1·2	17·3	1·9
54	1 43·5	1 43·8	1 38·8	5·4	0·6	11·4	1·2	17·4	1·9
55	1 43·8	1 44·0	1 39·0	5·5	0·6	11·5	1·2	17·5	1·9
56	1 44·0	1 44·3	1 39·3	5·6	0·6	11·6	1·3	17·6	1·9
57	1 44·3	1 44·5	1 39·5	5·7	0·6	11·7	1·3	17·7	1·9
58	1 44·5	1 44·8	1 39·7	5·8	0·6	11·8	1·3	17·8	1·9
59	1 44·8	1 45·0	1 40·0	5·9	0·6	11·9	1·3	17·9	1·9
60	1 45·0	1 45·3	1 40·2	6·0	0·7	12·0	1·3	18·0	2·0

m 7	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	1 45·0	1 45·3	1 40·2	0·0	0·0	6·0	0·8	12·0	1·5
01	1 45·3	1 45·5	1 40·5	0·1	0·0	6·1	0·8	12·1	1·5
02	1 45·5	1 45·8	1 40·7	0·2	0·0	6·2	0·8	12·2	1·5
03	1 45·8	1 46·0	1 40·9	0·3	0·0	6·3	0·8	12·3	1·5
04	1 46·0	1 46·3	1 41·2	0·4	0·1	6·4	0·8	12·4	1·6
05	1 46·3	1 46·5	1 41·4	0·5	0·1	6·5	0·8	12·5	1·6
06	1 46·5	1 46·8	1 41·6	0·6	0·1	6·6	0·8	12·6	1·6
07	1 46·8	1 47·0	1 41·9	0·7	0·1	6·7	0·8	12·7	1·6
08	1 47·0	1 47·3	1 42·1	0·8	0·1	6·8	0·9	12·8	1·6
09	1 47·3	1 47·5	1 42·4	0·9	0·1	6·9	0·9	12·9	1·6
10	1 47·5	1 47·8	1 42·6	1·0	0·1	7·0	0·9	13·0	1·6
11	1 47·8	1 48·0	1 42·8	1·1	0·1	7·1	0·9	13·1	1·6
12	1 48·0	1 48·3	1 43·1	1·2	0·2	7·2	0·9	13·2	1·7
13	1 48·3	1 48·5	1 43·3	1·3	0·2	7·3	0·9	13·3	1·7
14	1 48·5	1 48·8	1 43·6	1·4	0·2	7·4	0·9	13·4	1·7
15	1 48·8	1 49·0	1 43·8	1·5	0·2	7·5	0·9	13·5	1·7
16	1 49·0	1 49·3	1 44·0	1·6	0·2	7·6	1·0	13·6	1·7
17	1 49·3	1 49·5	1 44·3	1·7	0·2	7·7	1·0	13·7	1·7
18	1 49·5	1 49·8	1 44·5	1·8	0·2	7·8	1·0	13·8	1·7
19	1 49·8	1 50·1	1 44·8	1·9	0·2	7·9	1·0	13·9	1·7
20	1 50·0	1 50·3	1 45·0	2·0	0·3	8·0	1·0	14·0	1·8
21	1 50·3	1 50·6	1 45·2	2·1	0·3	8·1	1·0	14·1	1·8
22	1 50·5	1 50·8	1 45·5	2·2	0·3	8·2	1·0	14·2	1·8
23	1 50·8	1 51·1	1 45·7	2·3	0·3	8·3	1·0	14·3	1·8
24	1 51·0	1 51·3	1 45·9	2·4	0·3	8·4	1·1	14·4	1·8
25	1 51·3	1 51·6	1 46·2	2·5	0·3	8·5	1·1	14·5	1·8
26	1 51·5	1 51·8	1 46·4	2·6	0·3	8·6	1·1	14·6	1·8
27	1 51·8	1 52·1	1 46·7	2·7	0·3	8·7	1·1	14·7	1·8
28	1 52·0	1 52·3	1 46·9	2·8	0·4	8·8	1·1	14·8	1·9
29	1 52·3	1 52·6	1 47 1	2·9	0·4	8·9	1·1	14·9	1·9
30	1 52·5	1 52·8	1 47·4	3·0	0·4	9·0	1·1	15·0	1·9
31	1 52·8	1 53·1	1 47·6	3·1	0·4	9·1	1·1	15·1	1·9
32	1 53·0	1 53·3	1 47·9	3·2	0·4	9·2	1·2	15·2	1·9
33	1 53·3	1 53·6	1 48·1	3·3	0·4	9·3	1·2	15·3	1·9
34	1 53·5	1 53·8	1 48·3	3·4	0·4	9·4	1·2	15·4	1·9
35	1 53·8	1 54·1	1 48·6	3·5	0·4	9·5	1·2	15·5	1·9
36	1 54·0	1 54·3	1 48·8	3·6	0·5	9·6	1·2	15·6	2·0
37	1 54·3	1 54·6	1 49·0	3·7	0·5	9·7	1·2	15·7	2·0
38	1 54·5	1 54·8	1 49·3	3·8	0·5	9·8	1·2	15·8	2·0
39	1 54·8	1 55·1	1 49·5	3·9	0·5	9·9	1·2	15·9	2·0
40	1 55·0	1 55·3	1 49·8	4·0	0·5	10·0	1·3	16·0	2·0
41	1 55·3	1 55·6	1 50·0	4·1	0·5	10·1	1·3	16·1	2·0
42	1 55·5	1 55·8	1 50·2	4·2	0·5	10·2	1·3	16·2	2·0
43	1 55·8	1 56·1	1 50·5	4·3	0·5	10·3	1·3	16·3	2·0
44	1 56·0	1 56·3	1 50·7	4·4	0·6	10·4	1·3	16·4	2·1
45	1 56·3	1 56·6	1 51·0	4·5	0·6	10·5	1·3	16·5	2·1
46	1 56·5	1 56·8	1 51·2	4·6	0·6	10·6	1·3	16·6	2·1
47	1 56·8	1 57·1	1 51·4	4·7	0·6	10·7	1·3	16·7	2·1
48	1 57·0	1 57·3	1 51·7	4·8	0·6	10·8	1·4	16·8	2·1
49	1 57·3	1 57·6	1 51·9	4·9	0·6	10·9	1·4	16·9	2·1
50	1 57·5	1 57·8	1 52·1	5·0	0·6	11·0	1·4	17·0	2·1
51	1 57·8	1 58·1	1 52·4	5·1	0·6	11·1	1·4	17·1	2·1
52	1 58·0	1 58·3	1 52·6	5·2	0·7	11·2	1·4	17·2	2·2
53	1 58·3	1 58·6	1 52·9	5·3	0·7	11·3	1·4	17·3	2·2
54	1 58·5	1 58·8	1 53·1	5·4	0·7	11·4	1·4	17·4	2·2
55	1 58·8	1 59·1	1 53·3	5·5	0·7	11·5	1·4	17·5	2·2
56	1 59·0	1 59·3	1 53·6	5·6	0·7	11·6	1·5	17·6	2·2
57	1 59·3	1 59·6	1 53·8	5·7	0·7	11·7	1·5	17·7	2·2
58	1 59·5	1 59·8	1 54·1	5·8	0·7	11·8	1·5	17·8	2·2
59	1 59·8	2 00·1	1 54·3	5·9	0·7	11·9	1·5	17·9	2·2
60	2 00·0	2 00·3	1 54 5	6·0	0·8	12·0	1·5	18·0	2·3

m 8	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	2 00·0	2 00·3	1 54·5	0·0	0·0	6·0	0·9	12·0	1·7
01	2 00·3	2 00·6	1 54·8	0·1	0·0	6·1	0·9	12·1	1·7
02	2 00·5	2 00·8	1 55·0	0·2	0·0	6·2	0·9	12·2	1·7
03	2 00·8	2 01·1	1 55·2	0·3	0·0	6·3	0·9	12·3	1·7
04	2 01·0	2 01·3	1 55·5	0·4	0·1	6·4	0·9	12·4	1·8
05	2 01·3	2 01·6	1 55·7	0·5	0·1	6·5	0·9	12·5	1·8
06	2 01·5	2 01·8	1 56·0	0·6	0·1	6·6	0·9	12·6	1·8
07	2 01·8	2 02·1	1 56·2	0·7	0·1	6·7	0·9	12·7	1·8
08	2 02·0	2 02·3	1 56·4	0·8	0·1	6·8	1·0	12·8	1·8
09	2 02·3	2 02·6	1 56·7	0·9	0·1	6·9	1·0	12·9	1·8
10	2 02·5	2 02·8	1 56·9	1·0	0·1	7·0	1·0	13·0	1·8
11	2 02·8	2 03·1	1 57·2	1·1	0·2	7·1	1·0	13·1	1·9
12	2 03·0	2 03·3	1 57·4	1·2	0·2	7·2	1·0	13·2	1·9
13	2 03·3	2 03·6	1 57·6	1·3	0·2	7·3	1·0	13·3	1·9
14	2 03·5	2 03·8	1 57·9	1·4	0·2	7·4	1·0	13·4	1·9
15	2 03·8	2 04·1	1 58·1	1·5	0·2	7·5	1·1	13·5	1·9
16	2 04·0	2 04·3	1 58·4	1·6	0·2	7·6	1·1	13·6	1·9
17	2 04·3	2 04·6	1 58·6	1·7	0·2	7·7	1·1	13·7	1·9
18	2 04·5	2 04·8	1 58·8	1·8	0·3	7·8	1·1	13·8	2·0
19	2 04·8	2 05·1	1 59·1	1·9	0·3	7·9	1·1	13·9	2·0
20	2 05·0	2 05·3	1 59·3	2·0	0·3	8·0	1·1	14·0	2·0
21	2 05·3	2 05·6	1 59·5	2·1	0·3	8·1	1·1	14·1	2·0
22	2 05·5	2 05·8	1 59·8	2·2	0·3	8·2	1·2	14·2	2·0
23	2 05·8	2 06·1	2 00·0	2·3	0·3	8·3	1·2	14·3	2·0
24	2 06·0	2 06·3	2 00·3	2·4	0·3	8·4	1·2	14·4	2·0
25	2 06·3	2 06·6	2 00·5	2·5	0·4	8·5	1·2	14·5	2·1
26	2 06·5	2 06·8	2 00·7	2·6	0·4	8·6	1·2	14·6	2·1
27	2 06·8	2 07·1	2 01·0	2·7	0·4	8·7	1·2	14·7	2·1
28	2 07·0	2 07·3	2 01·2	2·8	0·4	8·8	1·2	14·8	2·1
29	2 07·3	2 07·6	2 01·5	2·9	0·4	8·9	1·3	14·9	2·1
30	2 07·5	2 07·8	2 01·7	3·0	0·4	9·0	1·3	15·0	2·1
31	2 07·8	2 08·1	2 01·9	3·1	0·4	9·1	1·3	15·1	2·1
32	2 08·0	2 08·4	2 02·2	3·2	0·5	9·2	1·3	15·2	2·2
33	2 08·3	2 08·6	2 02·4	3·3	0·5	9·3	1·3	15·3	2·2
34	2 08·5	2 08·9	2 02·6	3·4	0·5	9·4	1·3	15·4	2·2
35	2 08·8	2 09·1	2 02·9	3·5	0·5	9·5	1·3	15·5	2·2
36	2 09·0	2 09·4	2 03·1	3·6	0·5	9·6	1·4	15·6	2·2
37	2 09·3	2 09·6	2 03·4	3·7	0·5	9·7	1·4	15·7	2·2
38	2 09·5	2 09·9	2 03·6	3·8	0·5	9·8	1·4	15·8	2·2
39	2 09·8	2 10·1	2 03·8	3·9	0·6	9·9	1·4	15·9	2·3
40	2 10·0	2 10·4	2 04·1	4·0	0·6	10·0	1·4	16·0	2·3
41	2 10·3	2 10·6	2 04·3	4·1	0·6	10·1	1·4	16·1	2·3
42	2 10·5	2 10·9	2 04·6	4·2	0·6	10·2	1·4	16·2	2·3
43	2 10·8	2 11·1	2 04·8	4·3	0·6	10·3	1·5	16·3	2·3
44	2 11·0	2 11·4	2 05·0	4·4	0·6	10·4	1·5	16·4	2·3
45	2 11·3	2 11·6	2 05·3	4·5	0·6	10·5	1·5	16·5	2·3
46	2 11·5	2 11·9	2 05·5	4·6	0·7	10·6	1·5	16·6	2·4
47	2 11·8	2 12·1	2 05·7	4·7	0·7	10·7	1·5	16·7	2·4
48	2 12·0	2 12·4	2 06·0	4·8	0·7	10·8	1·5	16·8	2·4
49	2 12·3	2 12·6	2 06·2	4·9	0·7	10·9	1·5	16·9	2·4
50	2 12·5	2 12·9	2 06·5	5·0	0·7	11·0	1·6	17·0	2·4
51	2 12·8	2 13·1	2 06·7	5·1	0·7	11·1	1·6	17·1	2·4
52	2 13·0	2 13·4	2 06·9	5·2	0·7	11·2	1·6	17·2	2·4
53	2 13·3	2 13·6	2 07·2	5·3	0·8	11·3	1·6	17·3	2·5
54	2 13·5	2 13·9	2 07·4	5·4	0·8	11·4	1·6	17·4	2·5
55	2 13·8	2 14·1	2 07·7	5·5	0·8	11·5	1·6	17·5	2·5
56	2 14·0	2 14·4	2 07·9	5·6	0·8	11·6	1·6	17·6	2·5
57	2 14·3	2 14·6	2 08·1	5·7	0·8	11·7	1·7	17·7	2·5
58	2 14·5	2 14·9	2 08·4	5·8	0·8	11·8	1·7	17·8	2·5
59	2 14·8	2 15·1	2 08·6	5·9	0·8	11·9	1·7	17·9	2·5
60	2 15·0	2 15·4	2 08·9	6·0	0·9	12·0	1·7	18·0	2·6

m 9	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	2 15·0	2 15·4	2 08·9	0·0	0·0	6·0	1·0	12·0	1·9
01	2 15·3	2 15·6	2 09·1	0·1	0·0	6·1	1·0	12·1	1·9
02	2 15·5	2 15·9	2 09·3	0·2	0·0	6·2	1·0	12·2	1·9
03	2 15·8	2 16·1	2 09·6	0·3	0·0	6·3	1·0	12·3	1·9
04	2 16·0	2 16·4	2 09·8	0·4	0·1	6·4	1·0	12·4	2·0
05	2 16·3	2 16·6	2 10·0	0·5	0·1	6·5	1·0	12·5	2·0
06	2 16·5	2 16·9	2 10·3	0·6	0·1	6·6	1·0	12·6	2·0
07	2 16·8	2 17·1	2 10·5	0·7	0·1	6·7	1·1	12·7	2·0
08	2 17·0	2 17·4	2 10·8	0·8	0·1	6·8	1·1	12·8	2·0
09	2 17·3	2 17·6	2 11·0	0·9	0·1	6·9	1·1	12·9	2·0
10	2 17·5	2 17·9	2 11·2	1·0	0·2	7·0	1·1	13·0	2·1
11	2 17·8	2 18·1	2 11·5	1·1	0·2	7·1	1·1	13·1	2·1
12	2 18·0	2 18·4	2 11·7	1·2	0·2	7·2	1·1	13·2	2·1
13	2 18·3	2 18·6	2 12·0	1·3	0·2	7·3	1·2	13·3	2·1
14	2 18·5	2 18·9	2 12·2	1·4	0·2	7·4	1·2	13·4	2·1
15	2 18·8	2 19·1	2 12·4	1·5	0·2	7·5	1·2	13·5	2·1
16	2 19·0	2 19·4	2 12·7	1·6	0·3	7·6	1·2	13·6	2·2
17	2 19·3	2 19·6	2 12·9	1·7	0·3	7·7	1·2	13·7	2·2
18	2 19·5	2 19·9	2 13·1	1·8	0·3	7·8	1·2	13·8	2·2
19	2 19·8	2 20·1	2 13·4	1·9	0·3	7·9	1·3	13·9	2·2
20	2 20·0	2 20·4	2 13·6	2·0	0·3	8·0	1·3	14·0	2·2
21	2 20·3	2 20·6	2 13·9	2·1	0·3	8·1	1·3	14·1	2·2
22	2 20·5	2 20·9	2 14·1	2·2	0·3	8·2	1·3	14·2	2·2
23	2 20·8	2 21·1	2 14·3	2·3	0·4	8·3	1·3	14·3	2·3
24	2 21·0	2 21·4	2 14·6	2·4	0·4	8·4	1·3	14·4	2·3
25	2 21·3	2 21·6	2 14·8	2·5	0·4	8·5	1·3	14·5	2·3
26	2 21·5	2 21·9	2 15·1	2·6	0·4	8·6	1·4	14·6	2·3
27	2 21·8	2 22·1	2 15·3	2·7	0·4	8·7	1·4	14·7	2·3
28	2 22·0	2 22·4	2 15·5	2·8	0·4	8·8	1·4	14·8	2·3
29	2 22·3	2 22·6	2 15·8	2·9	0·5	8·9	1·4	14·9	2·4
30	2 22·5	2 22·9	2 16·0	3·0	0·5	9·0	1·4	15·0	2·4
31	2 22·8	2 23·1	2 16·2	3·1	0·5	9·1	1·4	15·1	2·4
32	2 23·0	2 23·4	2 16·5	3·2	0·5	9·2	1·5	15·2	2·4
33	2 23·3	2 23·6	2 16·7	3·3	0·5	9·3	1·5	15·3	2·4
34	2 23·5	2 23·9	2 17·0	3·4	0·5	9·4	1·5	15·4	2·4
35	2 23·8	2 24·1	2 17·2	3·5	0·6	9·5	1·5	15·5	2·5
36	2 24·0	2 24·4	2 17·4	3·6	0·6	9·6	1·5	15·6	2·5
37	2 24·3	2 24·6	2 17·7	3·7	0·6	9·7	1·5	15·7	2·5
38	2 24·5	2 24·9	2 17·9	3·8	0·6	9·8	1·6	15·8	2·5
39	2 24·8	2 25·1	2 18·2	3·9	0·6	9·9	1·6	15·9	2·5
40	2 25·0	2 25·4	2 18·4	4·0	0·6	10·0	1·6	16·0	2·5
41	2 25·3	2 25·6	2 18·6	4·1	0·6	10·1	1·6	16·1	2·5
42	2 25·5	2 25·9	2 18·9	4·2	0·7	10·2	1·6	16·2	2·6
43	2 25·8	2 26·1	2 19·1	4·3	0·7	10·3	1·6	16·3	2·6
44	2 26·0	2 26·4	2 19·3	4·4	0·7	10·4	1·6	16·4	2·6
45	2 26·3	2 26·7	2 19·6	4·5	0·7	10·5	1·7	16·5	2·6
46	2 26·5	2 26·9	2 19·8	4·6	0·7	10·6	1·7	16·6	2·6
47	2 26·8	2 27·2	2 20·1	4·7	0·7	10·7	1·7	16·7	2·6
48	2 27·0	2 27·4	2 20·3	4·8	0·8	10·8	1·7	16·8	2·7
49	2 27·3	2 27·7	2 20·5	4·9	0·8	10·9	1·7	16·9	2·7
50	2 27·5	2 27·9	2 20·8	5·0	0·8	11·0	1·7	17·0	2·7
51	2 27·8	2 28·2	2 21·0	5·1	0·8	11·1	1·8	17·1	2·7
52	2 28·0	2 28·4	2 21·3	5·2	0·8	11·2	1·8	17·2	2·7
53	2 28·3	2 28·7	2 21·5	5·3	0·8	11·3	1·8	17·3	2·7
54	2 28·5	2 28·9	2 21·7	5·4	0·9	11·4	1·8	17·4	2·8
55	2 28·8	2 29·2	2 22·0	5·5	0·9	11·5	1·8	17·5	2·8
56	2 29·0	2 29·4	2 22·2	5·6	0·9	11·6	1·8	17·6	2·8
57	2 29·3	2 29·7	2 22·5	5·7	0·9	11·7	1·9	17·7	2·8
58	2 29·5	2 29·9	2 22·7	5·8	0·9	11·8	1·9	17·8	2·8
59	2 29·8	2 30·2	2 22·9	5·9	0·9	11·9	1·9	17·9	2·8
60	2 30·0	2 30·4	2 23·2	6·0	1·0	12·0	1·9	18·0	2·9

m 10	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	2 30·0	2 30·4	2 23·2	0·0	0·0	6·0	1·1	12·0	2·1
01	2 30·3	2 30·7	2 23·4	0·1	0·0	6·1	1·1	12·1	2·1
02	2 30·5	2 30·9	2 23·6	0·2	0·0	6·2	1·1	12·2	2·1
03	2 30·8	2 31·2	2 23·9	0·3	0·1	6·3	1·1	12·3	2·2
04	2 31·0	2 31·4	2 24·1	0·4	0·1	6·4	1·1	12·4	2·2
05	2 31·3	2 31·7	2 24·4	0·5	0·1	6·5	1·1	12·5	2·2
06	2 31·5	2 31·9	2 24·6	0·6	0·1	6·6	1·2	12·6	2·2
07	2 31·8	2 32·2	2 24·8	0·7	0·1	6·7	1·2	12·7	2·2
08	2 32·0	2 32·4	2 25·1	0·8	0·1	6·8	1·2	12·8	2·2
09	2 32·3	2 32·7	2 25·3	0·9	0·2	6·9	1·2	12·9	2·3
10	2 32·5	2 32·9	2 25·6	1·0	0·2	7·0	1·2	13·0	2·3
11	2 32·8	2 33·2	2 25·8	1·1	0·2	7·1	1·2	13·1	2·3
12	2 33·0	2 33·4	2 26·0	1·2	0·2	7·2	1·3	13·2	2·3
13	2 33·3	2 33·7	2 26·3	1·3	0·2	7·3	1·3	13·3	2·3
14	2 33·5	2 33·9	2 26·5	1·4	0·2	7·4	1·3	13·4	2·3
15	2 33·8	2 34·2	2 26·7	1·5	0·3	7·5	1·3	13·5	2·4
16	2 34·0	2 34·4	2 27·0	1·6	0·3	7·6	1·3	13·6	2·4
17	2 34·3	2 34·7	2 27·2	1·7	0·3	7·7	1·3	13·7	2·4
18	2 34·5	2 34·9	2 27·5	1·8	0·3	7·8	1·4	13·8	2·4
19	2 34·8	2 35·2	2 27·7	1·9	0·3	7·9	1·4	13·9	2·4
20	2 35·0	2 35·4	2 27·9	2·0	0·4	8·0	1·4	14·0	2·5
21	2 35·3	2 35·7	2 28·2	2·1	0·4	8·1	1·4	14·1	2·5
22	2 35·5	2 35·9	2 28·4	2·2	0·4	8·2	1·4	14·2	2·5
23	2 35·8	2 36·2	2 28·7	2·3	0·4	8·3	1·5	14·3	2·5
24	2 36·0	2 36·4	2 28·9	2·4	0·4	8·4	1·5	14·4	2·5
25	2 36·3	2 36·7	2 29·1	2·5	0·4	8·5	1·5	14·5	2·5
26	2 36·5	2 36·9	2 29·4	2·6	0·5	8·6	1·5	14·6	2·6
27	2 36·8	2 37·2	2 29·6	2·7	0·5	8·7	1·5	14·7	2·6
28	2 37·0	2 37·4	2 29·8	2·8	0·5	8·8	1·5	14·8	2·6
29	2 37·3	2 37·7	2 30·1	2·9	0·5	8·9	1·6	14·9	2·6
30	2 37·5	2 37·9	2 30·3	3·0	0·5	9·0	1·6	15·0	2·6
31	2 37·8	2 38·2	2 30·6	3·1	0·5	9·1	1·6	15·1	2·6
32	2 38·0	2 38·4	2 30·8	3·2	0·6	9·2	1·6	15·2	2·7
33	2 38·3	2 38·7	2 31·0	3·3	0·6	9·3	1·6	15·3	2·7
34	2 38·5	2 38·9	2 31·3	3·4	0·6	9·4	1·6	15·4	2·7
35	2 38·8	2 39·2	2 31·5	3·5	0·6	9·5	1·7	15·5	2·7
36	2 39·0	2 39·4	2 31·8	3·6	0·6	9·6	1·7	15·6	2·7
37	2 39·3	2 39·7	2 32·0	3·7	0·6	9·7	1·7	15·7	2·7
38	2 39·5	2 39·9	2 32·2	3·8	0·7	9·8	1·7	15·8	2·8
39	2 39·8	2 40·2	2 32·5	3·9	0·7	9·9	1·7	15·9	2·8
40	2 40·0	2 40·4	2 32·7	4·0	0·7	10·0	1·8	16·0	2·8
41	2 40·3	2 40·7	2 32·9	4·1	0·7	10·1	1·8	16·1	2·8
42	2 40·5	2 40·9	2 33·2	4·2	0·7	10·2	1·8	16·2	2·8
43	2 40·8	2 41·2	2 33·4	4·3	0·8	10·3	1·8	16·3	2·9
44	2 41·0	2 41·4	2 33·7	4·4	0·8	10·4	1·8	16·4	2·9
45	2 41·3	2 41·7	2 33·9	4·5	0·8	10·5	1·8	16·5	2·9
46	2 41·5	2 41·9	2 34·1	4·6	0·8	10·6	1·9	16·6	2·9
47	2 41·8	2 42·2	2 34·4	4·7	0·8	10·7	1·9	16·7	2·9
48	2 42·0	2 42·4	2 34·6	4·8	0·8	10·8	1·9	16·8	2·9
49	2 42·3	2 42·7	2 34·9	4·9	0·9	10·9	1·9	16·9	3·0
50	2 42·5	2 42·9	2 35·1	5·0	0·9	11·0	1·9	17·0	3·0
51	2 42·8	2 43·2	2 35·3	5·1	0·9	11·1	1·9	17·1	3·0
52	2 43·0	2 43·4	2 35·6	5·2	0·9	11·2	2·0	17·2	3·0
53	2 43·3	2 43·7	2 35·8	5·3	0·9	11·3	2·0	17·3	3·0
54	2 43·5	2 43·9	2 36·1	5·4	0·9	11·4	2·0	17·4	3·0
55	2 43·8	2 44·2	2 36·3	5·5	1·0	11·5	2·0	17·5	3·1
56	2 44·0	2 44·4	2 36·5	5·6	1·0	11·6	2·0	17·6	3·1
57	2 44·3	2 44·7	2 36·8	5·7	1·0	11·7	2·0	17·7	3·1
58	2 44·5	2 45·0	2 37·0	5·8	1·0	11·8	2·1	17·8	3·1
59	2 44·8	2 45·2	2 37·2	5·9	1·0	11·9	2·1	17·9	3·1
60	2 45·0	2 45·5	2 37·5	6·0	1·1	12·0	2·1	18·0	3·2

m 11	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	2 45·0	2 45·5	2 37·5	0·0	0·0	6·0	1·2	12·0	2·3
01	2 45·3	2 45·7	2 37·7	0·1	0·0	6·1	1·2	12·1	2·3
02	2 45·5	2 46·0	2 38·0	0·2	0·0	6·2	1·2	12·2	2·3
03	2 45·8	2 46·2	2 38·2	0·3	0·1	6·3	1·2	12·3	2·4
04	2 46·0	2 46·5	2 38·4	0·4	0·1	6·4	1·2	12·4	2·4
05	2 46·3	2 46·7	2 38·7	0·5	0·1	6·5	1·2	12·5	2·4
06	2 46·5	2 47·0	2 38·9	0·6	0·1	6·6	1·3	12·6	2·4
07	2 46·8	2 47·2	2 39·2	0·7	0·1	6·7	1·3	12·7	2·4
08	2 47·0	2 47·5	2 39·4	0·8	0·2	6·8	1·3	12·8	2·5
09	2 47·3	2 47·7	2 39·6	0·9	0·2	6·9	1·3	12·9	2·5
10	2 47·5	2 48·0	2 39·9	1·0	0·2	7·0	1·3	13·0	2·5
11	2 47·8	2 48·2	2 40·1	1·1	0·2	7·1	1·4	13·1	2·5
12	2 48·0	2 48·5	2 40·3	1·2	0·2	7·2	1·4	13·2	2·5
13	2 48·3	2 48·7	2 40·6	1·3	0·2	7·3	1·4	13·3	2·5
14	2 48·5	2 49·0	2 40·8	1·4	0·3	7·4	1·4	13·4	2·6
15	2 48·8	2 49·2	2 41·1	1·5	0·3	7·5	1·4	13·5	2·6
16	2 49·0	2 49·5	2 41·3	1·6	0·3	7·6	1·5	13·6	2·6
17	2 49·3	2 49·7	2 41·5	1·7	0·3	7·7	1·5	13·7	2·6
18	2 49·5	2 50·0	2 41·8	1·8	0·3	7·8	1·5	13·8	2·6
19	2 49·8	2 50·2	2 42·0	1·9	0·4	7·9	1·5	13·9	2·7
20	2 50·0	2 50·5	2 42·3	2·0	0·4	8·0	1·5	14·0	2·7
21	2 50·3	2 50·7	2 42·5	2·1	0·4	8·1	1·6	14·1	2·7
22	2 50·5	2 51·0	2 42·7	2·2	0·4	8·2	1·6	14·2	2·7
23	2 50·8	2 51·2	2 43·0	2·3	0·4	8·3	1·6	14·3	2·7
24	2 51·0	2 51·5	2 43·2	2·4	0·5	8·4	1·6	14·4	2·8
25	2 51·3	2 51·7	2 43·4	2·5	0·5	8·5	1·6	14·5	2·8
26	2 51·5	2 52·0	2 43·7	2·6	0·5	8·6	1·6	14·6	2·8
27	2 51·8	2 52·2	2 43·9	2·7	0·5	8·7	1·7	14·7	2·8
28	2 52·0	2 52·5	2 44·2	2·8	0·5	8·8	1·7	14·8	2·8
29	2 52·3	2 52·7	2 44·4	2·9	0·6	8·9	1·7	14·9	2·9
30	2 52·5	2 53·0	2 44·6	3·0	0·6	9·0	1·7	15·0	2·9
31	2 52·8	2 53·2	2 44·9	3·1	0·6	9·1	1·7	15·1	2·9
32	2 53·0	2 53·5	2 45·1	3·2	0·6	9·2	1·8	15·2	2·9
33	2 53·3	2 53·7	2 45·4	3·3	0·6	9·3	1·8	15·3	2·9
34	2 53·5	2 54·0	2 45·6	3·4	0·7	9·4	1·8	15·4	3·0
35	2 53·8	2 54·2	2 45·8	3·5	0·7	9·5	1·8	15·5	3·0
36	2 54·0	2 54·5	2 46·1	3·6	0·7	9·6	1·8	15·6	3·0
37	2 54·3	2 54·7	2 46·3	3·7	0·7	9·7	1·9	15·7	3·0
38	2 54·5	2 55·0	2 46·6	3·8	0·7	9·8	1·9	15·8	3·0
39	2 54·8	2 55·2	2 46·8	3·9	0·7	9·9	1·9	15·9	3·0
40	2 55·0	2 55·5	2 47·0	4·0	0·8	10·0	1·9	16·0	3·1
41	2 55·3	2 55·7	2 47·3	4·1	0·8	10·1	1·9	16·1	3·1
42	2 55·5	2 56·0	2 47·5	4·2	0·8	10·2	2·0	16·2	3·1
43	2 55·8	2 56·2	2 47·7	4·3	0·8	10·3	2·0	16·3	3·1
44	2 56·0	2 56·5	2 48·0	4·4	0·8	10·4	2·0	16·4	3·1
45	2 56·3	2 56·7	2 48·2	4·5	0·9	10·5	2·0	16·5	3·2
46	2 56·5	2 57·0	2 48·5	4·6	0·9	10·6	2·0	16·6	3·2
47	2 56·8	2 57·2	2 48·7	4·7	0·9	10·7	2·1	16·7	3·2
48	2 57·0	2 57·5	2 48·9	4·8	0·9	10·8	2·1	16·8	3·2
49	2 57·3	2 57·7	2 49·2	4·9	0·9	10·9	2·1	16·9	3·2
50	2 57·5	2 58·0	2 49·4	5·0	1·0	11·0	2·1	17·0	3·3
51	2 57·8	2 58·2	2 49·7	5·1	1·0	11·1	2·1	17·1	3·3
52	2 58·0	2 58·5	2 49·9	5·2	1·0	11·2	2·1	17·2	3·3
53	2 58·3	2 58·7	2 50·1	5·3	1·0	11·3	2·2	17·3	3·3
54	2 58·5	2 59·0	2 50·4	5·4	1·0	11·4	2·2	17·4	3·3
55	2 58·8	2 59·2	2 50·6	5·5	1·1	11·5	2·2	17·5	3·4
56	2 59·0	2 59·5	2 50·8	5·6	1·1	11·6	2·2	17·6	3·4
57	2 59·3	2 59·7	2 51·1	5·7	1·1	11·7	2·2	17·7	3·4
58	2 59·5	3 00·0	2 51·3	5·8	1·1	11·8	2·3	17·8	3·4
59	2 59·8	3 00·2	2 51·6	5·9	1·1	11·9	2·3	17·9	3·4
60	3 00·0	3 00·5	2 51·8	6·0	1·2	12·0	2·3	18·0	3·5

m 12	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	3 00·0	3 00·5	2 51·8	0·0	0·0	6·0	1·3	12·0	2·5
01	3 00·3	3 00·7	2 52·0	0·1	0·0	6·1	1·3	12·1	2·5
02	3 00·5	3 01·0	2 52·3	0·2	0·0	6·2	1·3	12·2	2·5
03	3 00·8	3 01·2	2 52·5	0·3	0·1	6·3	1·3	12·3	2·6
04	3 01·0	3 01·5	2 52·8	0·4	0·1	6·4	1·3	12·4	2·6
05	3 01·3	3 01·7	2 53·0	0·5	0·1	6·5	1·4	12·5	2·6
06	3 01·5	3 02·0	2 53·2	0·6	0·1	6·6	1·4	12·6	2·6
07	3 01·8	3 02·2	2 53·5	0·7	0·1	6·7	1·4	12·7	2·6
08	3 02·0	3 02·5	2 53·7	0·8	0·2	6·8	1·4	12·8	2·7
09	3 02·3	3 02·7	2 53·9	0·9	0·2	6·9	1·4	12·9	2·7
10	3 02·5	3 03·0	2 54·2	1·0	0·2	7·0	1·5	13·0	2·7
11	3 02·8	3 03·3	2 54·4	1·1	0·2	7·1	1·5	13·1	2·7
12	3 03·0	3 03·5	2 54·7	1·2	0·3	7·2	1·5	13·2	2·8
13	3 03·3	3 03·8	2 54·9	1·3	0·3	7·3	1·5	13·3	2·8
14	3 03·5	3 04·0	2 55·1	1·4	0·3	7·4	1·5	13·4	2·8
15	3 03·8	3 04·3	2 55·4	1·5	0·3	7·5	1·6	13·5	2·8
16	3 04·0	3 04·5	2 55·6	1·6	0·3	7·6	1·6	13·6	2·8
17	3 04·3	3 04·8	2 55·9	1·7	0·4	7·7	1·6	13·7	2·9
18	3 04·5	3 05·0	2 56·1	1·8	0·4	7·8	1·6	13·8	2·9
19	3 04·8	3 05·3	2 56·3	1·9	0·4	7·9	1·6	13·9	2·9
20	3 05·0	3 05·5	2 56·6	2·0	0·4	8·0	1·7	14·0	2·9
21	3 05·3	3 05·8	2 56·8	2·1	0·4	8·1	1·7	14·1	2·9
22	3 05·5	3 06·0	2 57·0	2·2	0·5	8·2	1·7	14·2	3·0
23	3 05·8	3 06·3	2 57·3	2·3	0·5	8·3	1·7	14·3	3·0
24	3 06·0	3 06·5	2 57·5	2·4	0·5	8·4	1·8	14·4	3·0
25	3 06·3	3 06·8	2 57·8	2·5	0·5	8·5	1·8	14·5	3·0
26	3 06·5	3 07·0	2 58·0	2·6	0·5	8·6	1·8	14·6	3·0
27	3 06·8	3 07·3	2 58·2	2·7	0·6	8·7	1·8	14·7	3·1
28	3 07·0	3 07·5	2 58·5	2·8	0·6	8·8	1·8	14·8	3·1
29	3 07·3	3 07·8	2 58·7	2·9	0·6	8·9	1·9	14·9	3·1
30	3 07·5	3 08·0	2 59·0	3·0	0·6	9·0	1·9	15·0	3·1
31	3 07·8	3 08·3	2 59·2	3·1	0·6	9·1	1·9	15·1	3·1
32	3 08·0	3 08·5	2 59·4	3·2	0·7	9·2	1·9	15·2	3·2
33	3 08·3	3 08·8	2 59·7	3·3	0·7	9·3	1·9	15·3	3·2
34	3 08·5	3 09·0	2 59·9	3·4	0·7	9·4	2·0	15·4	3·2
35	3 08·8	3 09·3	3 00·2	3·5	0·7	9·5	2·0	15·5	3·2
36	3 09·0	3 09·5	3 00·4	3·6	0·8	9·6	2·0	15·6	3·3
37	3 09·3	3 09·8	3 00·6	3·7	0·8	9·7	2·0	15·7	3·3
38	3 09·5	3 10·0	3 00·9	3·8	0·8	9·8	2·0	15·8	3·3
39	3 09·8	3 10·3	3 01·1	3·9	0·8	9·9	2·1	15·9	3·3
40	3 10·0	3 10·5	3 01·3	4·0	0·8	10·0	2·1	16·0	3·3
41	3 10·3	3 10·8	3 01·6	4·1	0·9	10·1	2·1	16·1	3·4
42	3 10·5	3 11·0	3 01·8	4·2	0·9	10·2	2·1	16·2	3·4
43	3 10·8	3 11·3	3 02·1	4·3	0·9	10·3	2·1	16·3	3·4
44	3 11·0	3 11·5	3 02·3	4·4	0·9	10·4	2·2	16·4	3·4
45	3 11·3	3 11·8	3 02·5	4·5	0·9	10·5	2·2	16·5	3·4
46	3 11·5	3 12·0	3 02·8	4·6	1·0	10·6	2·2	16·6	3·5
47	3 11·8	3 12·3	3 03·0	4·7	1·0	10·7	2·2	16·7	3·5
48	3 12·0	3 12·5	3 03·3	4·8	1·0	10·8	2·3	16·8	3·5
49	3 12·3	3 12·8	3 03·5	4·9	1·0	10·9	2·3	16·9	3·5
50	3 12·5	3 13·0	3 03·7	5·0	1·0	11·0	2·3	17·0	3·5
51	3 12·8	3 13·3	3 04·0	5·1	1·1	11·1	2·3	17·1	3·6
52	3 13·0	3 13·5	3 04·2	5·2	1·1	11·2	2·3	17·2	3·6
53	3 13·3	3 13·8	3 04·4	5·3	1·1	11·3	2·4	17·3	3·6
54	3 13·5	3 14·0	3 04·7	5·4	1·1	11·4	2·4	17·4	3·6
55	3 13·8	3 14·3	3 04·9	5·5	1·1	11·5	2·4	17·5	3·6
56	3 14·0	3 14·5	3 05·2	5·6	1·2	11·6	2·4	17·6	3·7
57	3 14·3	3 14·8	3 05·4	5·7	1·2	11·7	2·4	17·7	3·7
58	3 14·5	3 15·0	3 05·6	5·8	1·2	11·8	2·5	17·8	3·7
59	3 14·8	3 15·3	3 05·9	5·9	1·2	11·9	2·5	17·9	3·7
60	3 15·0	3 15·5	3 06·1	6·0	1·3	12·0	2·5	18·0	3·8

m 13	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	3 15·0	3 15·5	3 06·1	0·0	0·0	6·0	1·4	12·0	2·7
01	3 15·3	3 15·8	3 06·4	0·1	0·0	6·1	1·4	12·1	2·7
02	3 15·5	3 16·0	3 06·6	0·2	0·0	6·2	1·4	12·2	2·7
03	3 15·8	3 16·3	3 06·8	0·3	0·1	6·3	1·4	12·3	2·8
04	3 16·0	3 16·5	3 07·1	0·4	0·1	6·4	1·4	12·4	2·8
05	3 16·3	3 16·8	3 07·3	0·5	0·1	6·5	1·5	12·5	2·8
06	3 16·5	3 17·0	3 07·5	0·6	0·1	6·6	1·5	12·6	2·8
07	3 16·8	3 17·3	3 07·8	0·7	0·2	6·7	1·5	12·7	2·9
08	3 17·0	3 17·5	3 08·0	0·8	0·2	6·8	1·5	12·8	2·9
09	3 17·3	3 17·8	3 08·3	0·9	0·2	6·9	1·6	12·9	2·9
10	3 17·5	3 18·0	3 08·5	1·0	0·2	7·0	1·6	13·0	2·9
11	3 17·8	3 18·3	3 08·7	1·1	0·2	7·1	1·6	13·1	2·9
12	3 18·0	3 18·5	3 09·0	1·2	0·3	7·2	1·6	13·2	3·0
13	3 18·3	3 18·8	3 09·2	1·3	0·3	7·3	1·6	13·3	3·0
14	3 18·5	3 19·0	3 09·5	1·4	0·3	7·4	1·7	13·4	3·0
15	3 18·8	3 19·3	3 09·7	1·5	0·3	7·5	1·7	13·5	3·0
16	3 19·0	3 19·5	3 09·9	1·6	0·4	7·6	1·7	13·6	3·1
17	3 19·3	3 19·8	3 10·2	1·7	0·4	7·7	1·7	13·7	3·1
18	3 19·5	3 20·0	3 10·4	1·8	0·4	7·8	1·8	13·8	3·1
19	3 19·8	3 20·3	3 10·7	1·9	0·4	7·9	1·8	13·9	3·1
20	3 20·0	3 20·5	3 10·9	2·0	0·5	8·0	1·8	14·0	3·2
21	3 20·3	3 20·8	3 11·1	2·1	0·5	8·1	1·8	14·1	3·2
22	3 20·5	3 21·0	3 11·4	2·2	0·5	8·2	1·8	14·2	3·2
23	3 20·8	3 21·3	3 11·6	2·3	0·5	8·3	1·9	14·3	3·2
24	3 21·0	3 21·6	3 11·8	2·4	0·5	8·4	1·9	14·4	3·2
25	3 21·3	3 21·8	3 12·1	2·5	0·6	8·5	1·9	14·5	3·3
26	3 21·5	3 22·1	3 12·3	2·6	0·6	8·6	1·9	14·6	3·3
27	3 21·8	3 22·3	3 12·6	2·7	0·6	8·7	2·0	14·7	3·3
28	3 22·0	3 22·6	3 12·8	2·8	0·6	8·8	2·0	14·8	3·3
29	3 22·3	3 22·8	3 13·0	2·9	0·7	8·9	2·0	14·9	3·4
30	3 22·5	3 23·1	3 13·3	3·0	0·7	9·0	2·0	15·0	3·4
31	3 22·8	3 23·3	3 13·5	3·1	0·7	9·1	2·0	15·1	3·4
32	3 23·0	3 23·6	3 13·8	3·2	0·7	9·2	2·1	15·2	3·4
33	3 23·3	3 23·8	3 14·0	3·3	0·7	9·3	2·1	15·3	3·4
34	3 23·5	3 24·1	3 14·2	3·4	0·8	9·4	2·1	15·4	3·5
35	3 23·8	3 24·3	3 14·5	3·5	0·8	9·5	2·1	15·5	3·5
36	3 24·0	3 24·6	3 14·7	3·6	0·8	9·6	2·2	15·6	3·5
37	3 24·3	3 24·8	3 14·9	3·7	0·8	9·7	2·2	15·7	3·5
38	3 24·5	3 25·1	3 15·2	3·8	0·9	9·8	2·2	15·8	3·6
39	3 24·8	3 25·3	3 15·4	3·9	0·9	9·9	2·2	15·9	3·6
40	3 25·0	3 25·6	3 15·7	4·0	0·9	10·0	2·3	16·0	3·6
41	3 25·3	3 25·8	3 15·9	4·1	0·9	10·1	2·3	16·1	3·6
42	3 25·5	3 26·1	3 16·1	4·2	0·9	10·2	2·3	16·2	3·6
43	3 25·8	3 26·3	3 16·4	4·3	1·0	10·3	2·3	16·3	3·7
44	3 26·0	3 26·6	3 16·6	4·4	1·0	10·4	2·3	16·4	3·7
45	3 26·3	3 26·8	3 16·9	4·5	1·0	10·5	2·4	16·5	3·7
46	3 26·5	3 27·1	3 17·1	4·6	1·0	10·6	2·4	16·6	3·7
47	3 26·8	3 27·3	3 17·3	4·7	1·1	10·7	2·4	16·7	3·8
48	3 27·0	3 27·6	3 17·6	4·8	1·1	10·8	2·4	16·8	3·8
49	3 27·3	3 27·8	3 17·8	4·9	1·1	10·9	2·5	16·9	3·8
50	3 27·5	3 28·1	3 18·0	5·0	1·1	11·0	2·5	17·0	3·8
51	3 27·8	3 28·3	3 18·3	5·1	1·1	11·1	2·5	17·1	3·8
52	3 28·0	3 28·6	3 18·5	5·2	1·2	11·2	2·5	17·2	3·9
53	3 28·3	3 28·8	3 18·8	5·3	1·2	11·3	2·5	17·3	3·9
54	3 28·5	3 29·1	3 19·0	5·4	1·2	11·4	2·6	17·4	3·9
55	3 28·8	3 29·3	3 19·2	5·5	1·2	11·5	2·6	17·5	3·9
56	3 29·0	3 29·6	3 19·5	5·6	1·3	11·6	2·6	17·6	4·0
57	3 29·3	3 29·8	3 19·7	5·7	1·3	11·7	2·6	17·7	4·0
58	3 29·5	3 30·1	3 20·0	5·8	1·3	11·8	2·7	17·8	4·0
59	3 29·8	3 30·3	3 20·2	5·9	1·3	11·9	2·7	17·9	4·0
60	3 30·0	3 30·6	3 20·4	6·0	1·4	12·0	2·7	18·0	4·1

m 14	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	3 30·0	3 30·6	3 20·4	0·0	0·0	6·0	1·5	12·0	2·9
01	3 30·3	3 30·8	3 20·7	0·1	0·0	6·1	1·5	12·1	2·9
02	3 30·5	3 31·1	3 20·9	0·2	0·0	6·2	1·5	12·2	2·9
03	3 30·8	3 31·3	3 21·1	0·3	0·1	6·3	1·5	12·3	3·0
04	3 31·0	3 31·6	3 21·4	0·4	0·1	6·4	1·5	12·4	3·0
05	3 31·3	3 31·8	3 21·6	0·5	0·1	6·5	1·6	12·5	3·0
06	3 31·5	3 32·1	3 21·9	0·6	0·1	6·6	1·6	12·6	3·0
07	3 31·8	3 32·3	3 22·1	0·7	0·2	6·7	1·6	12·7	3·1
08	3 32·0	3 32·6	3 22·3	0·8	0·2	6·8	1·6	12·8	3·1
09	3 32·3	3 32·8	3 22·6	0·9	0·2	6·9	1·7	12·9	3·1
10	3 32·5	3 33·1	3 22·8	1·0	0·2	7·0	1·7	13·0	3·1
11	3 32·8	3 33·3	3 23·1	1·1	0·3	7·1	1·7	13·1	3·2
12	3 33·0	3 33·6	3 23·3	1·2	0·3	7·2	1·7	13·2	3·2
13	3 33·3	3 33·8	3 23·5	1·3	0·3	7·3	1·8	13·3	3·2
14	3 33·5	3 34·1	3 23·8	1·4	0·3	7·4	1·8	13·4	3·2
15	3 33·8	3 34·3	3 24·0	1·5	0·4	7·5	1·8	13·5	3·3
16	3 34·0	3 34·6	3 24·3	1·6	0·4	7·6	1·8	13·6	3·3
17	3 34·3	3 34·8	3 24·5	1·7	0·4	7·7	1·9	13·7	3·3
18	3 34·5	3 35·1	3 24·7	1·8	0·4	7·8	1·9	13·8	3·3
19	3 34·8	3 35·3	3 25·0	1·9	0·5	7·9	1·9	13·9	3·4
20	3 35·0	3 35·6	3 25·2	2·0	0·5	8·0	1·9	14·0	3·4
21	3 35·3	3 35·8	3 25·4	2·1	0·5	8·1	2·0	14·1	3·4
22	3 35·5	3 36·1	3 25·7	2·2	0·5	8·2	2·0	14·2	3·4
23	3 35·8	3 36·3	3 25·9	2·3	0·6	8·3	2·0	14·3	3·5
24	3 36·0	3 36·6	3 26·2	2·4	0·6	8·4	2·0	14·4	3·5
25	3 36·3	3 36·8	3 26·4	2·5	0·6	8·5	2·1	14·5	3·5
26	3 36·5	3 37·1	3 26·6	2·6	0·6	8·6	2·1	14·6	3·5
27	3 36·8	3 37·3	3 26·9	2·7	0·7	8·7	2·1	14·7	3·6
28	3 37·0	3 37·6	3 27·1	2·8	0·7	8·8	2·1	14·8	3·6
29	3 37·3	3 37·8	3 27·4	2·9	0·7	8·9	2·2	14·9	3·6
30	3 37·5	3 38·1	3 27·6	3·0	0·7	9·0	2·2	15·0	3·6
31	3 37·8	3 38·3	3 27·8	3·1	0·7	9·1	2·2	15·1	3·6
32	3 38·0	3 38·6	3 28·1	3·2	0·8	9·2	2·2	15·2	3·7
33	3 38·3	3 38·8	3 28·3	3·3	0·8	9·3	2·2	15·3	3·7
34	3 38·5	3 39·1	3 28·5	3·4	0·8	9·4	2·3	15·4	3·7
35	3 38·8	3 39·3	3 28·8	3·5	0·8	9·5	2·3	15·5	3·7
36	3 39·0	3 39·6	3 29·0	3·6	0·9	9·6	2·3	15·6	3·8
37	3 39·3	3 39·9	3 29·3	3·7	0·9	9·7	2·3	15·7	3·8
38	3 39·5	3 40·1	3 29·5	3·8	0·9	9·8	2·4	15·8	3·8
39	3 39·8	3 40·4	3 29·7	3·9	0·9	9·9	2·4	15·9	3·8
40	3 40·0	3 40·6	3 30·0	4·0	1·0	10·0	2·4	16·0	3·9
41	3 40·3	3 40·9	3 30·2	4·1	1·0	10·1	2·4	16·1	3·9
42	3 40·5	3 41·1	3 30·5	4·2	1·0	10·2	2·5	16·2	3·9
43	3 40·8	3 41·4	3 30·7	4·3	1·0	10·3	2·5	16·3	3·9
44	3 41·0	3 41·6	3 30·9	4·4	1·1	10·4	2·5	16·4	4·0
45	3 41·3	3 41·9	3 31·2	4·5	1·1	10·5	2·5	16·5	4·0
46	3 41·5	3 42·1	3 31·4	4·6	1·1	10·6	2·6	16·6	4·0
47	3 41·8	3 42·4	3 31·6	4·7	1·1	10·7	2·6	16·7	4·0
48	3 42·0	3 42·6	3 31·9	4·8	1·2	10·8	2·6	16·8	4·1
49	3 42·3	3 42·9	3 32·1	4·9	1·2	10·9	2·6	16·9	4·1
50	3 42·5	3 43·1	3 32·4	5·0	1·2	11·0	2·7	17·0	4·1
51	3 42·8	3 43·4	3 32·6	5·1	1·2	11·1	2·7	17·1	4·1
52	3 43·0	3 43·6	3 32·8	5·2	1·3	11·2	2·7	17·2	4·2
53	3 43·3	3 43·9	3 33·1	5·3	1·3	11·3	2·7	17·3	4·2
54	3 43·5	3 44·1	3 33·3	5·4	1·3	11·4	2·8	17·4	4·2
55	3 43·8	3 44·4	3 33·6	5·5	1·3	11·5	2·8	17·5	4·2
56	3 44·0	3 44·6	3 33·8	5·6	1·4	11·6	2·8	17·6	4·3
57	3 44·3	3 44·9	3 34·0	5·7	1·4	11·7	2·8	17·7	4·3
58	3 44·5	3 45·1	3 34·3	5·8	1·4	11·8	2·9	17·8	4·3
59	3 44·8	3 45·4	3 34·5	5·9	1·4	11·9	2·9	17·9	4·3
60	3 45·0	3 45·6	3 34·8	6·0	1·5	12·0	2·9	18·0	4·4

m 15	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	3 45·0	3 45·6	3 34·8	0·0	0·0	6·0	1·6	12·0	3·1
01	3 45·3	3 45·9	3 35·0	0·1	0·0	6·1	1·6	12·1	3·1
02	3 45·5	3 46·1	3 35·2	0·2	0·1	6·2	1·6	12·2	3·2
03	3 45·8	3 46·4	3 35·5	0·3	0·1	6·3	1·6	12·3	3·2
04	3 46·0	3 46·6	3 35·7	0·4	0·1	6·4	1·7	12·4	3·2
05	3 46·3	3 46·9	3 35·9	0·5	0·1	6·5	1·7	12·5	3·2
06	3 46·5	3 47·1	3 36·2	0·6	0·2	6·6	1·7	12·6	3·3
07	3 46·8	3 47·4	3 36·4	0·7	0·2	6·7	1·7	12·7	3·3
08	3 47·0	3 47·6	3 36·7	0·8	0·2	6·8	1·8	12·8	3·3
09	3 47·3	3 47·9	3 36·9	0·9	0·2	6·9	1·8	12·9	3·3
10	3 47·5	3 48·1	3 37·1	1·0	0·3	7·0	1·8	13·0	3·4
11	3 47·8	3 48·4	3 37·4	1·1	0·3	7·1	1·8	13·1	3·4
12	3 48·0	3 48·6	3 37·6	1·2	0·3	7·2	1·9	13·2	3·4
13	3 48·3	3 48·9	3 37·9	1·3	0·3	7·3	1·9	13·3	3·4
14	3 48·5	3 49·1	3 38·1	1·4	0·4	7·4	1·9	13·4	3·5
15	3 48·8	3 49·4	3 38·3	1·5	0·4	7·5	1·9	13·5	3·5
16	3 49·0	3 49·6	3 38·6	1·6	0·4	7·6	2·0	13·6	3·5
17	3 49·3	3 49·9	3 38·8	1·7	0·4	7·7	2·0	13·7	3·5
18	3 49·5	3 50·1	3 39·0	1·8	0·5	7·8	2·0	13·8	3·6
19	3 49·8	3 50·4	3 39·3	1·9	0·5	7·9	2·0	13·9	3·6
20	3 50·0	3 50·6	3 39·5	2·0	0·5	8·0	2·1	14·0	3·6
21	3 50·3	3 50·9	3 39·8	2·1	0·5	8·1	2·1	14·1	3·6
22	3 50·5	3 51·1	3 40·0	2·2	0·6	8·2	2·1	14·2	3·7
23	3 50·8	3 51·4	3 40·2	2·3	0·6	8·3	2·1	14·3	3·7
24	3 51·0	3 51·6	3 40·5	2·4	0·6	8·4	2·2	14·4	3·7
25	3 51·3	3 51·9	3 40·7	2·5	0·6	8·5	2·2	14·5	3·7
26	3 51·5	3 52·1	3 41·0	2·6	0·7	8·6	2·2	14·6	3·8
27	3 51·8	3 52·4	3 41·2	2·7	0·7	8·7	2·2	14·7	3·8
28	3 52·0	3 52·6	3 41·4	2·8	0·7	8·8	2·3	14·8	3·8
29	3 52·3	3 52·9	3 41·7	2·9	0·7	8·9	2·3	14·9	3·8
30	3 52·5	3 53·1	3 41·9	3·0	0·8	9·0	2·3	15·0	3·9
31	3 52·8	3 53·4	3 42·1	3·1	0·8	9·1	2·4	15·1	3·9
32	3 53·0	3 53·6	3 42·4	3·2	0·8	9·2	2·4	15·2	3·9
33	3 53·3	3 53·9	3 42·6	3·3	0·9	9·3	2·4	15·3	4·0
34	3 53·5	3 54·1	3 42·9	3·4	0·9	9·4	2·4	15·4	4·0
35	3 53·8	3 54·4	3 43·1	3·5	0·9	9·5	2·5	15·5	4·0
36	3 54·0	3 54·6	3 43·3	3·6	0·9	9·6	2·5	15·6	4·0
37	3 54·3	3 54·9	3 43·6	3·7	1·0	9·7	2·5	15·7	4·1
38	3 54·5	3 55·1	3 43·8	3·8	1·0	9·8	2·5	15·8	4·1
39	3 54·8	3 55·4	3 44·1	3·9	1·0	9·9	2·6	15·9	4·1
40	3 55·0	3 55·6	3 44·3	4·0	1·0	10·0	2·6	16·0	4·1
41	3 55·3	3 55·9	3 44·5	4·1	1·1	10·1	2·6	16·1	4·2
42	3 55·5	3 56·1	3 44·8	4·2	1·1	10·2	2·6	16·2	4·2
43	3 55·8	3 56·4	3 45·0	4·3	1·1	10·3	2·7	16·3	4·2
44	3 56·0	3 56·6	3 45·2	4·4	1·1	10·4	2·7	16·4	4·2
45	3 56·3	3 56·9	3 45·5	4·5	1·2	10·5	2·7	16·5	4·3
46	3 56·5	3 57·1	3 45·7	4·6	1·2	10·6	2·7	16·6	4·3
47	3 56·8	3 57·4	3 46·0	4·7	1·2	10·7	2·8	16·7	4·3
48	3 57·0	3 57·6	3 46·2	4·8	1·2	10·8	2·8	16·8	4·3
49	3 57·3	3 57·9	3 46·4	4·9	1·3	10·9	2·8	16·9	4·4
50	3 57·5	3 58·2	3 46·7	5·0	1·3	11·0	2·8	17·0	4·4
51	3 57·8	3 58·4	3 46·9	5·1	1·3	11·1	2·9	17·1	4·4
52	3 58·0	3 58·7	3 47·2	5·2	1·3	11·2	2·9	17·2	4·4
53	3 58·3	3 58·9	3 47·4	5·3	1·4	11·3	2·9	17·3	4·5
54	3 58·5	3 59·2	3 47·6	5·4	1·4	11·4	2·9	17·4	4·5
55	3 58·8	3 59·4	3 47·9	5·5	1·4	11·5	3·0	17·5	4·5
56	3 59·0	3 59·7	3 48·1	5·6	1·4	11·6	3·0	17·6	4·5
57	3 59·3	3 59·9	3 48·4	5·7	1·5	11·7	3·0	17·7	4·6
58	3 59·5	4 00·2	3 48·6	5·8	1·5	11·8	3·0	17·8	4·6
59	3 59·8	4 00·4	3 48·8	5·9	1·5	11·9	3·1	17·9	4·6
60	4 00·0	4 00·7	3 49·1	6·0	1·6	12·0	3·1	18·0	4·7

m 16	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	4 00·0	4 00·7	3 49·1	0·0	0·0	6·0	1·7	12·0	3·3
01	4 00·3	4 00·9	3 49·3	0·1	0·0	6·1	1·7	12·1	3·3
02	4 00·5	4 01·2	3 49·5	0·2	0·1	6·2	1·7	12·2	3·4
03	4 00·8	4 01·4	3 49·8	0·3	0·1	6·3	1·7	12·3	3·4
04	4 01·0	4 01·7	3 50·0	0·4	0·1	6·4	1·8	12·4	3·4
05	4 01·3	4 01·9	3 50·3	0·5	0·1	6·5	1·8	12·5	3·4
06	4 01·5	4 02·2	3 50·5	0·6	0·2	6·6	1·8	12·6	3·5
07	4 01·8	4 02·4	3 50·7	0·7	0·2	6·7	1·8	12·7	3·5
08	4 02·0	4 02·7	3 51·0	0·8	0·2	6·8	1·9	12·8	3·5
09	4 02·3	4 02·9	3 51·2	0·9	0·2	6·9	1·9	12·9	3·5
10	4 02·5	4 03·2	3 51·5	1·0	0·3	7·0	1·9	13·0	3·6
11	4 02·8	4 03·4	3 51·7	1·1	0·3	7·1	2·0	13·1	3·6
12	4 03·0	4 03·7	3 51·9	1·2	0·3	7·2	2·0	13·2	3·6
13	4 03·3	4 03·9	3 52·2	1·3	0·4	7·3	2·0	13·3	3·7
14	4 03·5	4 04·2	3 52·4	1·4	0·4	7·4	2·0	13·4	3·7
15	4 03·8	4 04·4	3 52·6	1·5	0·4	7·5	2·1	13·5	3·7
16	4 04·0	4 04·7	3 52·9	1·6	0·4	7·6	2·1	13·6	3·7
17	4 04·3	4 04·9	3 53·1	1·7	0·5	7·7	2·1	13·7	3·8
18	4 04·5	4 05·2	3 53·4	1·8	0·5	7·8	2·1	13·8	3·8
19	4 04·8	4 05·4	3 53·6	1·9	0·5	7·9	2·2	13·9	3·8
20	4 05·0	4 05·7	3 53·8	2·0	0·6	8·0	2·2	14·0	3·9
21	4 05·3	4 05·9	3 54·1	2·1	0·6	8·1	2·2	14·1	3·9
22	4 05·5	4 06·2	3 54·3	2·2	0·6	8·2	2·3	14·2	3·9
23	4 05·8	4 06·4	3 54·6	2·3	0·6	8·3	2·3	14·3	3·9
24	4 06·0	4 06·7	3 54·8	2·4	0·7	8·4	2·3	14·4	4·0
25	4 06·3	4 06·9	3 55·0	2·5	0·7	8·5	2·3	14·5	4·0
26	4 06·5	4 07·2	3 55·3	2·6	0·7	8·6	2·4	14·6	4·0
27	4 06·8	4 07·4	3 55·5	2·7	0·7	8·7	2·4	14·7	4·0
28	4 07·0	4 07·7	3 55·7	2·8	0·8	8·8	2·4	14·8	4·1
29	4 07·3	4 07·9	3 56·0	2·9	0·8	8·9	2·4	14·9	4·1
30	4 07·5	4 08·2	3 56·2	3·0	0·8	9·0	2·5	15·0	4·1
31	4 07·8	4 08·4	3 56·5	3·1	0·9	9·1	2·5	15·1	4·2
32	4 08·0	4 08·7	3 56·7	3·2	0·9	9·2	2·5	15·2	4·2
33	4 08·3	4 08·9	3 56·9	3·3	0·9	9·3	2·6	15·3	4·2
34	4 08·5	4 09·2	3 57·2	3·4	0 9	9·4	2·6	15·4	4·2
35	4 08·8	4 09·4	3 57·4	3·5	1·0	9·5	2·6	15·5	4·3
36	4 09·0	4 09·7	3 57·7	3·6	1·0	9·6	2·6	15·6	4·3
37	4 09·3	4 09·9	3 57·9	3·7	1·0	9·7	2·7	15·7	4·3
38	4 09·5	4 10·2	3 58·1	3·8	1·0	9·8	2·7	15·8	4·3
39	4 09·8	4 10·4	3 58·4	3·9	1·1	9·9	2·7	15·9	4·4
40	4 10·0	4 10·7	3 58·6	4·0	1·1	10·0	2·8	16·0	4·4
41	4 10·3	4 10·9	3 58·8	4·1	1·1	10·1	2·8	16·1	4·4
42	4 10·5	4 11·2	3 59·1	4·2	1·2	10·2	2·8	16·2	4·5
43	4 10·8	4 11·4	3 59·3	4·3	1·2	10·3	2·8	16·3	4·5
44	4 11·0	4 11·7	3 59·6	4·4	1·2	10·4	2·9	16·4	4·5
45	4 11·3	4 11·9	3 59·8	4·5	1·2	10·5	2·9	16·5	4·5
46	4 11·5	4 12·2	4 00·0	4·6	1·3	10·6	2·9	16·6	4·6
47	4 11·8	4 12·4	4 00·3	4·7	1·3	10·7	2·9	16·7	4·6
48	4 12·0	4 12·7	4 00·5	4·8	1·3	10·8	3·0	16·8	4·6
49	4 12·3	4 12·9	4 00·8	4·9	1·3	10·9	3·0	16·9	4·6
50	4 12·5	4 13·2	4 01·0	5·0	1·4	11·0	3·0	17·0	4·7
51	4 12·8	4 13·4	4 01·2	5·1	1·4	11·1	3·1	17·1	4·7
52	4 13·0	4 13·7	4 01·5	5·2	1·4	11·2	3·1	17·2	4·7
53	4 13·3	4 13·9	4 01·7	5·3	1·5	11·3	3·1	17·3	4·8
54	4 13·5	4 14·2	4 02·0	5·4	1·5	11·4	3·1	17·4	4·8
55	4 13·8	4 14·4	4 02·2	5·5	1·5	11·5	3·2	17·5	4·8
56	4 14·0	4 14·7	4 02·4	5·6	1·5	11·6	3·2	17·6	4·8
57	4 14·3	4 14·9	4 02·7	5·7	1·6	11·7	3·2	17·7	4·9
58	4 14·5	4 15·2	4 02·9	5·8	1·6	11·8	3·2	17·8	4·9
59	4 14·8	4 15·4	4 03·1	5·9	1·6	11·9	3·3	17·9	4·9
60	4 15·0	4 15·7	4 03·4	6·0	1·7	12·0	3·3	18·0	5·0

m 17	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	4 15·0	4 15·7	4 03·4	0·0	0·0	6·0	1·8	12·0	3·5
01	4 15·3	4 15·9	4 03·6	0·1	0·0	6·1	1·8	12·1	3·5
02	4 15·5	4 16·2	4 03·9	0·2	0·1	6·2	1·8	12·2	3·6
03	4 15·8	4 16·5	4 04·1	0·3	0·1	6·3	1·8	12·3	3·6
04	4 16·0	4 16·7	4 04·3	0·4	0·1	6·4	1·9	12·4	3·6
05	4 16·3	4 17·0	4 04·6	0·5	0·1	6·5	1·9	12·5	3·6
06	4 16·5	4 17·2	4 04·8	0·6	0·2	6·6	1·9	12·6	3·7
07	4 16·8	4 17·5	4 05·1	0·7	0·2	6·7	2·0	12·7	3·7
08	4 17·0	4 17·7	4 05·3	0·8	0·2	6·8	2·0	12·8	3·7
09	4 17·3	4 18·0	4 05·5	0·9	0·3	6·9	2·0	12·9	3·8
10	4 17·5	4 18·2	4 05·8	1·0	0·3	7·0	2·0	13·0	3·8
11	4 17·8	4 18·5	4 06·0	1·1	0·3	7·1	2·1	13·1	3·8
12	4 18·0	4 18·7	4 06·2	1·2	0·4	7·2	2·1	13·2	3·9
13	4 18·3	4 19·0	4 06·5	1·3	0·4	7·3	2·1	13·3	3·9
14	4 18·5	4 19·2	4 06·7	1·4	0·4	7·4	2·2	13·4	3·9
15	4 18·8	4 19·5	4 07·0	1·5	0·4	7·5	2·2	13·5	3·9
16	4 19·0	4 19·7	4 07·2	1·6	0·5	7·6	2·2	13·6	4·0
17	4 19·3	4 20·0	4 07·4	1·7	0·5	7·7	2·2	13·7	4·0
18	4 19·5	4 20·2	4 07·7	1·8	0·5	7·8	2·3	13·8	4·0
19	4 19·8	4 20·5	4 07·9	1·9	0·6	7·9	2·3	13·9	4·1
20	4 20·0	4 20·7	4 08·2	2·0	0·6	8·0	2·3	14·0	4·1
21	4 20·3	4 21·0	4 08·4	2·1	0·6	8·1	2·4	14·1	4·1
22	4 20·5	4 21·2	4 08·6	2·2	0·6	8·2	2·4	14·2	4·1
23	4 20·8	4 21·5	4 08·9	2·3	0·7	8·3	2·4	14·3	4·2
24	4 21·0	4 21·7	4 09·1	2·4	0·7	8·4	2·5	14·4	4·2
25	4 21·3	4 22·0	4 09·3	2·5	0·7	8·5	2·5	14·5	4·2
26	4 21·5	4 22·2	4 09·6	2·6	0·8	8·6	2·5	14·6	4·3
27	4 21·8	4 22·5	4 09·8	2·7	0·8	8·7	2·5	14·7	4·3
28	4 22·0	4 22·7	4 10·1	2·8	0·8	8·8	2·6	14·8	4·3
29	4 22·3	4 23·0	4 10·3	2·9	0·8	8·9	2·6	14·9	4·3
30	4 22·5	4 23·2	4 10·5	3·0	0·9	9·0	2·6	15·0	4·4
31	4 22·8	4 23·5	4 10·8	3·1	0·9	9·1	2·7	15·1	4·4
32	4 23·0	4 23·7	4 11·0	3·2	0·9	9·2	2·7	15·2	4·4
33	4 23·3	4 24·0	4 11·3	3·3	1·0	9·3	2·7	15·3	4·5
34	4 23·5	4 24·2	4 11·5	3·4	1·0	9·4	2·7	15·4	4·5
35	4 23·8	4 24·5	4 11·7	3·5	1·0	9·5	2·8	15·5	4·5
36	4 24·0	4 24·7	4 12·0	3·6	1·1	9·6	2·8	15·6	4·6
37	4 24·3	4 25·0	4 12·2	3·7	1·1	9·7	2·8	15·7	4·6
38	4 24·5	4 25·2	4 12·5	3·8	1·1	9·8	2·9	15·8	4·6
39	4 24·8	4 25·5	4 12·7	3·9	1·1	9·9	2·9	15·9	4·6
40	4 25·0	4 25·7	4 12·9	4·0	1·2	10·0	2·9	16·0	4·7
41	4 25·3	4 26·0	4 13·2	4·1	1·2	10·1	2·9	16·1	4·7
42	4 25·5	4 26·2	4 13·4	4·2	1·2	10·2	3·0	16·2	4·7
43	4 25·8	4 26·5	4 13·6	4·3	1·3	10·3	3·0	16·3	4·8
44	4 26·0	4 26·7	4 13·9	4·4	1·3	10·4	3·0	16·4	4·8
45	4 26·3	4 27·0	4 14·1	4·5	1·3	10·5	3·1	16·5	4·8
46	4 26·5	4 27·2	4 14·4	4·6	1·3	10·6	3·1	16·6	4·8
47	4 26·8	4 27·5	4 14·6	4·7	1·4	10·7	3·1	16·7	4·9
48	4 27·0	4 27·7	4 14·8	4·8	1·4	10·8	3·2	16·8	4·9
49	4 27·3	4 28·0	4 15·1	4·9	1·4	10·9	3·2	16·9	4·9
50	4 27·5	4 28·2	4 15·3	5·0	1·5	11·0	3·2	17·0	5·0
51	4 27·8	4 28·5	4 15·6	5·1	1·5	11·1	3·2	17·1	5·0
52	4 28·0	4 28·7	4 15·8	5·2	1·5	11·2	3·3	17·2	5·0
53	4 28·3	4 29·0	4 16·0	5·3	1·5	11·3	3·3	17·3	5·0
54	4 28·5	4 29·2	4 16·3	5·4	1·6	11·4	3·3	17·4	5·1
55	4 28·8	4 29·5	4 16·5	5·5	1·6	11·5	3·4	17·5	5·1
56	4 29·0	4 29·7	4 16·7	5·6	1·6	11·6	3·4	17·6	5·1
57	4 29·3	4 30·0	4 17·0	5·7	1·7	11·7	3·4	17·7	5·2
58	4 29·5	4 30·2	4 17·2	5·8	1·7	11·8	3·4	17·8	5·2
59	4 29·8	4 30·5	4 17·5	5·9	1·7	11·9	3·5	17·9	5·2
60	4 30·0	4 30·7	4 17·7	6·0	1·8	12·0	3·5	18·0	5·3

18m s	SUN PLANETS ° ′	ARIES ° ′	MOON ° ′	v or d ′	Corrn ′	v or d ′	Corrn ′	v or d ′	Corrn ′
00	4 30·0	4 30·7	4 17·7	0·0	0·0	6·0	1·9	12·0	3·7
01	4 30·3	4 31·0	4 17·9	0·1	0·0	6·1	1·9	12·1	3·7
02	4 30·5	4 31·2	4 18·2	0·2	0·1	6·2	1·9	12·2	3·8
03	4 30·8	4 31·5	4 18·4	0·3	0·1	6·3	1·9	12·3	3·8
04	4 31·0	4 31·7	4 18·7	0·4	0·1	6·4	2·0	12·4	3·8
05	4 31·3	4 32·0	4 18·9	0·5	0·2	6·5	2·0	12·5	3·9
06	4 31·5	4 32·2	4 19·1	0·6	0·2	6·6	2·0	12·6	3·9
07	4 31·8	4 32·5	4 19·4	0·7	0·2	6·7	2·1	12·7	3·9
08	4 32·0	4 32·7	4 19·6	0·8	0·2	6·8	2·1	12·8	3·9
09	4 32·3	4 33·0	4 19·8	0·9	0·3	6·9	2·1	12·9	4·0
10	4 32·5	4 33·2	4 20·1	1·0	0·3	7·0	2·2	13·0	4·0
11	4 32·8	4 33·5	4 20·3	1·1	0·3	7·1	2·2	13·1	4·0
12	4 33·0	4 33·7	4 20·6	1·2	0·4	7·2	2·2	13·2	4·1
13	4 33·3	4 34·0	4 20·8	1·3	0·4	7·3	2·3	13·3	4·1
14	4 33·5	4 34·2	4 21·0	1·4	0·4	7·4	2·3	13·4	4·1
15	4 33·8	4 34·5	4 21·3	1·5	0·5	7·5	2·3	13·5	4·2
16	4 34·0	4 34·8	4 21·5	1·6	0·5	7·6	2·3	13·6	4·2
17	4 34·3	4 35·0	4 21·8	1·7	0·5	7·7	2·4	13·7	4·2
18	4 34·5	4 35·3	4 22·0	1·8	0·6	7·8	2·4	13·8	4·3
19	4 34·8	4 35·5	4 22·2	1·9	0·6	7·9	2·4	13·9	4·3
20	4 35·0	4 35·8	4 22·5	2·0	0·6	8·0	2·5	14·0	4·3
21	4 35·3	4 36·0	4 22·7	2·1	0·6	8·1	2·5	14·1	4·3
22	4 35·5	4 36·3	4 22·9	2·2	0·7	8·2	2·5	14·2	4·4
23	4 35·8	4 36·5	4 23·2	2·3	0·7	8·3	2·6	14·3	4·4
24	4 36·0	4 36·8	4 23·4	2·4	0·7	8·4	2·6	14·4	4·4
25	4 36·3	4 37·0	4 23·7	2·5	0·8	8·5	2·6	14·5	4·5
26	4 36·5	4 37·3	4 23·9	2·6	0·8	8·6	2·7	14·6	4·5
27	4 36·8	4 37·5	4 24·1	2·7	0·8	8·7	2·7	14·7	4·5
28	4 37·0	4 37·8	4 24·4	2·8	0·9	8·8	2·7	14·8	4·6
29	4 37·3	4 38·0	4 24·6	2·9	0·9	8·9	2·7	14·9	4·6
30	4 37·5	4 38·3	4 24·9	3·0	0·9	9·0	2·8	15·0	4·6
31	4 37·8	4 38·5	4 25·1	3·1	1·0	9·1	2·8	15·1	4·7
32	4 38·0	4 38·8	4 25·3	3·2	1·0	9·2	2·8	15·2	4·7
33	4 38·3	4 39·0	4 25·6	3·3	1·0	9·3	2·9	15·3	4·7
34	4 38·5	4 39·3	4 25·8	3·4	1·0	9·4	2·9	15·4	4·7
35	4 38·8	4 39·5	4 26·1	3·5	1·1	9·5	2·9	15·5	4·8
36	4 39·0	4 39·8	4 26·3	3·6	1·1	9·6	3·0	15·6	4·8
37	4 39·3	4 40·0	4 26·5	3·7	1·1	9·7	3·0	15·7	4·8
38	4 39·5	4 40·3	4 26·8	3·8	1·2	9·8	3·0	15·8	4·9
39	4 39·8	4 40·5	4 27·0	3·9	1·2	9·9	3·1	15·9	4·9
40	4 40·0	4 40·8	4 27·2	4·0	1·2	10·0	3·1	16·0	4·9
41	4 40·3	4 41·0	4 27·5	4·1	1·3	10·1	3·1	16·1	5·0
42	4 40·5	4 41·3	4 27·7	4·2	1·3	10·2	3·1	16·2	5·0
43	4 40·8	4 41·5	4 28·0	4·3	1·3	10·3	3·2	16·3	5·0
44	4 41·0	4 41·8	4 28·2	4·4	1·4	10·4	3·2	16·4	5·1
45	4 41·3	4 42·0	4 28·4	4·5	1·4	10·5	3·2	16·5	5·1
46	4 41·5	4 42·3	4 28·7	4·6	1·4	10·6	3·3	16·6	5·1
47	4 41·8	4 42·5	4 28·9	4·7	1·4	10·7	3·3	16·7	5·1
48	4 42·0	4 42·8	4 29·2	4·8	1·5	10·8	3·3	16·8	5·2
49	4 42·3	4 43·0	4 29·4	4·9	1·5	10·9	3·4	16·9	5·2
50	4 42·5	4 43·3	4 29·6	5·0	1·5	11·0	3·4	17·0	5·2
51	4 42·8	4 43·5	4 29·9	5·1	1·6	11·1	3·4	17·1	5·3
52	4 43·0	4 43·8	4 30·1	5·2	1·6	11·2	3·5	17·2	5·3
53	4 43·3	4 44·0	4 30·3	5·3	1·6	11·3	3·5	17·3	5·3
54	4 43·5	4 44·3	4 30·6	5·4	1·7	11·4	3·5	17·4	5·4
55	4 43·8	4 44·5	4 30·8	5·5	1·7	11·5	3·5	17·5	5·4
56	4 44·0	4 44·8	4 31·1	5·6	1·7	11·6	3·6	17·6	5·4
57	4 44·3	4 45·0	4 31·3	5·7	1·8	11·7	3·6	17·7	5·5
58	4 44·5	4 45·3	4 31·5	5·8	1·8	11·8	3·6	17·8	5·5
59	4 44·8	4 45·5	4 31·8	5·9	1·8	11·9	3·7	17·9	5·5
60	4 45·0	4 45·8	4 32·0	6·0	1·9	12·0	3·7	18·0	5·6

19m s	SUN PLANETS ° ′	ARIES ° ′	MOON ° ′	v or d ′	Corrn ′	v or d ′	Corrn ′	v or d ′	Corrn ′
00	4 45·0	4 45·8	4 32·0	0·0	0·0	6·0	2·0	12·0	3·9
01	4 45·3	4 46·0	4 32·3	0·1	0·0	6·1	2·0	12·1	3·9
02	4 45·5	4 46·3	4 32·5	0·2	0·1	6·2	2·0	12·2	4·0
03	4 45·8	4 46·5	4 32·7	0·3	0·1	6·3	2·0	12·3	4·0
04	4 46·0	4 46·8	4 33·0	0·4	0·1	6·4	2·1	12·4	4·0
05	4 46·3	4 47·0	4 33·2	0·5	0·2	6·5	2·1	12·5	4·1
06	4 46·5	4 47·3	4 33·4	0·6	0·2	6·6	2·1	12·6	4·1
07	4 46·8	4 47·5	4 33·7	0·7	0·2	6·7	2·2	12·7	4·1
08	4 47·0	4 47·8	4 33·9	0·8	0·3	6·8	2·2	12·8	4·2
09	4 47·3	4 48·0	4 34·2	0·9	0·3	6·9	2·2	12·9	4·2
10	4 47·5	4 48·3	4 34·4	1·0	0·3	7·0	2·3	13·0	4·2
11	4 47·8	4 48·5	4 34·6	1·1	0·4	7·1	2·3	13·1	4·3
12	4 48·0	4 48·8	4 34·9	1·2	0·4	7·2	2·3	13·2	4·3
13	4 48·3	4 49·0	4 35·1	1·3	0·4	7·3	2·4	13·3	4·3
14	4 48·5	4 49·3	4 35·4	1·4	0·5	7·4	2·4	13·4	4·4
15	4 48·8	4 49·5	4 35·6	1·5	0·5	7·5	2·4	13·5	4·4
16	4 49·0	4 49·8	4 35·8	1·6	0·5	7·6	2·5	13·6	4·4
17	4 49·3	4 50·0	4 36·1	1·7	0·6	7·7	2·5	13·7	4·5
18	4 49·5	4 50·3	4 36·3	1·8	0·6	7·8	2·5	13·8	4·5
19	4 49·8	4 50·5	4 36·6	1·9	0·6	7·9	2·6	13·9	4·5
20	4 50·0	4 50·8	4 36·8	2·0	0·7	8·0	2·6	14·0	4·6
21	4 50·3	4 51·0	4 37·0	2·1	0·7	8·1	2·6	14·1	4·6
22	4 50·5	4 51·3	4 37·3	2·2	0·7	8·2	2·7	14·2	4·6
23	4 50·8	4 51·5	4 37·5	2·3	0·7	8·3	2·7	14·3	4·6
24	4 51·0	4 51·8	4 37·7	2·4	0·8	8·4	2·7	14·4	4·7
25	4 51·3	4 52·0	4 38·0	2·5	0·8	8·5	2·8	14·5	4·7
26	4 51·5	4 52·3	4 38·2	2·6	0·8	8·6	2·8	14·6	4·7
27	4 51·8	4 52·5	4 38·5	2·7	0·9	8·7	2·8	14·7	4·8
28	4 52·0	4 52·8	4 38·7	2·8	0·9	8·8	2·9	14·8	4·8
29	4 52·3	4 53·1	4 38·9	2·9	0·9	8·9	2·9	14·9	4·8
30	4 52·5	4 53·3	4 39·2	3·0	1·0	9·0	2·9	15·0	4·9
31	4 52·8	4 53·6	4 39·4	3·1	1·0	9·1	3·0	15·1	4·9
32	4 53·0	4 53·8	4 39·7	3·2	1·0	9·2	3·0	15·2	4·9
33	4 53·3	4 54·1	4 39·9	3·3	1·1	9·3	3·0	15·3	5·0
34	4 53·5	4 54·3	4 40·1	3·4	1·1	9·4	3·1	15·4	5·0
35	4 53·8	4 54·6	4 40·4	3·5	1·1	9·5	3·1	15·5	5·0
36	4 54·0	4 54·8	4 40·6	3·6	1·2	9·6	3·1	15·6	5·1
37	4 54·3	4 55·1	4 40·8	3·7	1·2	9·7	3·2	15·7	5·1
38	4 54·5	4 55·3	4 41·1	3·8	1·2	9·8	3·2	15·8	5·1
39	4 54·8	4 55·6	4 41·3	3·9	1·3	9·9	3·2	15·9	5·2
40	4 55·0	4 55·8	4 41·6	4·0	1·3	10·0	3·3	16·0	5·2
41	4 55·3	4 56·1	4 41·8	4·1	1·3	10·1	3·3	16·1	5·2
42	4 55·5	4 56·3	4 42·0	4·2	1·4	10·2	3·3	16·2	5·3
43	4 55·8	4 56·6	4 42·3	4·3	1·4	10·3	3·3	16·3	5·3
44	4 56·0	4 56·8	4 42·5	4·4	1·4	10·4	3·4	16·4	5·3
45	4 56·3	4 57·1	4 42·8	4·5	1·5	10·5	3·4	16·5	5·4
46	4 56·5	4 57·3	4 43·0	4·6	1·5	10·6	3·4	16·6	5·4
47	4 56·8	4 57·6	4 43·2	4·7	1·5	10·7	3·5	16·7	5·4
48	4 57·0	4 57·8	4 43·5	4·8	1·6	10·8	3·5	16·8	5·5
49	4 57·3	4 58·1	4 43·7	4·9	1·6	10·9	3·5	16·9	5·5
50	4 57·5	4 58·3	4 43·9	5·0	1·6	11·0	3·6	17·0	5·5
51	4 57·8	4 58·6	4 44·2	5·1	1·7	11·1	3·6	17·1	5·6
52	4 58·0	4 58·8	4 44·4	5·2	1·7	11·2	3·6	17·2	5·6
53	4 58·3	4 59·1	4 44·7	5·3	1·7	11·3	3·7	17·3	5·6
54	4 58·5	4 59·3	4 44·9	5·4	1·8	11·4	3·7	17·4	5·7
55	4 58·8	4 59·6	4 45·1	5·5	1·8	11·5	3·7	17·5	5·7
56	4 59·0	4 59·8	4 45·4	5·6	1·8	11·6	3·8	17·6	5·7
57	4 59·3	5 00·1	4 45·6	5·7	1·9	11·7	3·8	17·7	5·8
58	4 59·5	5 00·3	4 45·9	5·8	1·9	11·8	3·8	17·8	5·8
59	4 59·8	5 00·6	4 46·1	5·9	1·9	11·9	3·9	17·9	5·8
60	5 00·0	5 00·8	4 46·3	6·0	2·0	12·0	3·9	18·0	5·9

m 20	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	5 00·0	5 00·8	4 46·3	0·0	0·0	6·0	2·1	12·0	4·1
01	5 00·3	5 01·1	4 46·6	0·1	0·0	6·1	2·1	12·1	4·1
02	5 00·5	5 01·3	4 46·8	0·2	0·1	6·2	2·1	12·2	4·2
03	5 00·8	5 01·6	4 47·0	0·3	0·1	6·3	2·2	12·3	4·2
04	5 01·0	5 01·8	4 47·3	0·4	0·1	6·4	2·2	12·4	4·2
05	5 01·3	5 02·1	4 47·5	0·5	0·2	6·5	2·2	12·5	4·3
06	5 01·5	5 02·3	4 47·8	0·6	0·2	6·6	2·3	12·6	4·3
07	5 01·8	5 02·6	4 48·0	0·7	0·2	6·7	2·3	12·7	4·3
08	5 02·0	5 02·8	4 48·2	0·8	0·3	6·8	2·3	12·8	4·4
09	5 02·3	5 03·1	4 48·5	0·9	0·3	6·9	2·4	12·9	4·4
10	5 02·5	5 03·3	4 48·7	1·0	0·3	7·0	2·4	13·0	4·4
11	5 02·8	5 03·6	4 49·0	1·1	0·4	7·1	2·4	13·1	4·5
12	5 03·0	5 03·8	4 49·2	1·2	0·4	7·2	2·5	13·2	4·5
13	5 03·3	5 04·1	4 49·4	1·3	0·4	7·3	2·5	13·3	4·5
14	5 03·5	5 04·3	4 49·7	1·4	0·5	7·4	2·5	13·4	4·6
15	5 03·8	5 04·6	4 49·9	1·5	0·5	7·5	2·6	13·5	4·6
16	5 04·0	5 04·8	4 50·2	1·6	0·5	7·6	2·6	13·6	4·6
17	5 04·3	5 05·1	4 50·4	1·7	0·6	7·7	2·6	13·7	4·7
18	5 04·5	5 05·3	4 50·6	1·8	0·6	7·8	2·7	13·8	4·7
19	5 04·8	5 05·6	4 50·9	1·9	0·6	7·9	2·7	13·9	4·7
20	5 05·0	5 05·8	4 51·1	2·0	0·7	8·0	2·7	14·0	4·8
21	5 05·3	5 06·1	4 51·3	2·1	0·7	8·1	2·8	14·1	4·8
22	5 05·5	5 06·3	4 51·6	2·2	0·8	8·2	2·8	14·2	4·9
23	5 05·8	5 06·6	4 51·8	2·3	0·8	8·3	2·8	14·3	4·9
24	5 06·0	5 06·8	4 52·1	2·4	0·8	8·4	2·9	14·4	4·9
25	5 06·3	5 07·1	4 52·3	2·5	0·9	8·5	2·9	14·5	5·0
26	5 06·5	5 07·3	4 52·5	2·6	0·9	8·6	2·9	14·6	5·0
27	5 06·8	5 07·6	4 52·8	2·7	0·9	8·7	3·0	14·7	5·0
28	5 07·0	5 07·8	4 53·0	2·8	1·0	8·8	3·0	14·8	5·1
29	5 07·3	5 08·1	4 53·3	2·9	1·0	8·9	3·0	14·9	5·1
30	5 07·5	5 08·3	4 53·5	3·0	1·0	9·0	3·1	15·0	5·1
31	5 07·8	5 08·6	4 53·7	3·1	1·1	9·1	3·1	15·1	5·2
32	5 08·0	5 08·8	4 54·0	3·2	1·1	9·2	3·1	15·2	5·2
33	5 08·3	5 09·1	4 54·2	3·3	1·1	9·3	3·2	15·3	5·2
34	5 08·5	5 09·3	4 54·4	3·4	1·2	9·4	3·2	15·4	5·3
35	5 08·8	5 09·6	4 54·7	3·5	1·2	9·5	3·2	15·5	5·3
36	5 09·0	5 09·8	4 54·9	3·6	1·2	9·6	3·3	15·6	5·3
37	5 09·3	5 10·1	4 55·2	3·7	1·3	9·7	3·3	15·7	5·4
38	5 09·5	5 10·3	4 55·4	3·8	1·3	9·8	3·3	15·8	5·4
39	5 09·8	5 10·6	4 55·6	3·9	1·3	9·9	3·4	15·9	5·4
40	5 10·0	5 10·8	4 55·9	4·0	1·4	10·0	3·4	16·0	5·5
41	5 10·3	5 11·1	4 56·1	4·1	1·4	10·1	3·5	16·1	5·5
42	5 10·5	5 11·4	4 56·4	4·2	1·4	10·2	3·5	16·2	5·5
43	5 10·8	5 11·6	4 56·6	4·3	1·5	10·3	3·5	16·3	5·6
44	5 11·0	5 11·9	4 56·8	4·4	1·5	10·4	3·6	16·4	5·6
45	5 11·3	5 12·1	4 57·1	4·5	1·5	10·5	3·6	16·5	5·6
46	5 11·5	5 12·4	4 57·3	4·6	1·6	10·6	3·6	16·6	5·7
47	5 11·8	5 12·6	4 57·5	4·7	1·6	10·7	3·7	16·7	5·7
48	5 12·0	5 12·9	4 57·8	4·8	1·6	10·8	3·7	16·8	5·7
49	5 12·3	5 13·1	4 58·0	4·9	1·7	10·9	3·7	16·9	5·8
50	5 12·5	5 13·4	4 58·3	5·0	1·7	11·0	3·8	17·0	5·8
51	5 12·8	5 13·6	4 58·5	5·1	1·7	11·1	3·8	17·1	5·8
52	5 13·0	5 13·9	4 58·7	5·2	1·8	11·2	3·8	17·2	5·9
53	5 13·3	5 14·1	4 59·0	5·3	1·8	11·3	3·9	17·3	5·9
54	5 13·5	5 14·4	4 59·2	5·4	1·8	11·4	3·9	17·4	5·9
55	5 13·8	5 14·6	4 59·5	5·5	1·9	11·5	3·9	17·5	6·0
56	5 14·0	5 14·9	4 59·7	5·6	1·9	11·6	4·0	17·6	6·0
57	5 14·3	5 15·1	4 59·9	5·7	1·9	11·7	4·0	17·7	6·0
58	5 14·5	5 15·4	5 00·2	5·8	2·0	11·8	4·0	17·8	6·1
59	5 14·8	5 15·6	5 00·4	5·9	2·0	11·9	4·1	17·9	6·1
60	5 15·0	5 15·9	5 00·7	6·0	2·1	12·0	4·1	18·0	6·2

m 21	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	5 15·0	5 15·9	5 00·7	0·0	0·0	6·0	2·2	12·0	4·3
01	5 15·3	5 16·1	5 00·9	0·1	0·0	6·1	2·2	12·1	4·3
02	5 15·5	5 16·4	5 01·1	0·2	0·1	6·2	2·2	12·2	4·4
03	5 15·8	5 16·6	5 01·4	0·3	0·1	6·3	2·3	12·3	4·4
04	5 16·0	5 16·9	5 01·6	0·4	0·1	6·4	2·3	12·4	4·4
05	5 16·3	5 17·1	5 01·8	0·5	0·2	6·5	2·3	12·5	4·5
06	5 16·5	5 17·4	5 02·1	0·6	0·2	6·6	2·4	12·6	4·5
07	5 16·8	5 17·6	5 02·3	0·7	0·3	6·7	2·4	12·7	4·6
08	5 17·0	5 17·9	5 02·6	0·8	0·3	6·8	2·4	12·8	4·6
09	5 17·3	5 18·1	5 02·8	0·9	0·3	6·9	2·5	12·9	4·6
10	5 17·5	5 18·4	5 03·0	1·0	0·4	7·0	2·5	13·0	4·7
11	5 17·8	5 18·6	5 03·3	1·1	0·4	7·1	2·5	13·1	4·7
12	5 18·0	5 18·9	5 03·5	1·2	0·4	7·2	2·6	13·2	4·7
13	5 18·3	5 19·1	5 03·8	1·3	0·5	7·3	2·6	13·3	4·8
14	5 18·5	5 19·4	5 04·0	1·4	0·5	7·4	2·7	13·4	4·8
15	5 18·8	5 19·6	5 04·2	1·5	0·5	7·5	2·7	13·5	4·8
16	5 19·0	5 19·9	5 04·5	1·6	0·6	7·6	2·7	13·6	4·9
17	5 19·3	5 20·1	5 04·7	1·7	0·6	7·7	2·8	13·7	4·9
18	5 19·5	5 20·4	5 04·9	1·8	0·6	7·8	2·8	13·8	4·9
19	5 19·8	5 20·6	5 05·2	1·9	0·7	7·9	2·8	13·9	5·0
20	5 20·0	5 20·9	5 05·4	2·0	0·7	8·0	2·9	14·0	5·0
21	5 20·3	5 21·1	5 05·7	2·1	0·8	8·1	2·9	14·1	5·1
22	5 20·5	5 21·4	5 05·9	2·2	0·8	8·2	2·9	14·2	5·1
23	5 20·8	5 21·6	5 06·1	2·3	0·8	8·3	3·0	14·3	5·1
24	5 21·0	5 21·9	5 06·4	2·4	0·9	8·4	3·0	14·4	5·2
25	5 21·3	5 22·1	5 06·6	2·5	0·9	8·5	3·0	14·5	5·2
26	5 21·5	5 22·4	5 06·9	2·6	0·9	8·6	3·1	14·6	5·2
27	5 21·8	5 22·6	5 07·1	2·7	1·0	8·7	3·1	14·7	5·3
28	5 22·0	5 22·9	5 07·3	2·8	1·0	8·8	3·2	14·8	5·3
29	5 22·3	5 23·1	5 07·6	2·9	1·0	8·9	3·2	14·9	5·3
30	5 22·5	5 23·4	5 07·8	3·0	1·1	9·0	3·2	15·0	5·4
31	5 22·8	5 23·6	5 08·0	3·1	1·1	9·1	3·3	15·1	5·4
32	5 23·0	5 23·9	5 08·3	3·2	1·1	9·2	3·3	15·2	5·4
33	5 23·3	5 24·1	5 08·5	3·3	1·2	9·3	3·3	15·3	5·5
34	5 23·5	5 24·4	5 08·8	3·4	1·2	9·4	3·4	15·4	5·5
35	5 23·8	5 24·6	5 09·0	3·5	1·3	9·5	3·4	15·5	5·6
36	5 24·0	5 24·9	5 09·2	3·6	1·3	9·6	3·4	15·6	5·6
37	5 24·3	5 25·1	5 09·5	3·7	1·3	9·7	3·5	15·7	5·6
38	5 24·5	5 25·4	5 09·7	3·8	1·4	9·8	3·5	15·8	5·7
39	5 24·8	5 25·6	5 10·0	3·9	1·4	9·9	3·5	15·9	5·7
40	5 25·0	5 25·9	5 10·2	4·0	1·4	10·0	3·6	16·0	5·7
41	5 25·3	5 26·1	5 10·4	4·1	1·5	10·1	3·6	16·1	5·8
42	5 25·5	5 26·4	5 10·7	4·2	1·5	10·2	3·7	16·2	5·8
43	5 25·8	5 26·6	5 10·9	4·3	1·5	10·3	3·7	16·3	5·8
44	5 26·0	5 26·9	5 11·1	4·4	1·6	10·4	3·7	16·4	5·9
45	5 26·3	5 27·1	5 11·4	4·5	1·6	10·5	3·8	16·5	5·9
46	5 26·5	5 27·4	5 11·6	4·6	1·6	10·6	3·8	16·6	5·9
47	5 26·8	5 27·6	5 11·9	4·7	1·7	10·7	3·8	16·7	6·0
48	5 27·0	5 27·9	5 12·1	4·8	1·7	10·8	3·9	16·8	6·0
49	5 27·3	5 28·1	5 12·3	4·9	1·8	10·9	3·9	16·9	6·1
50	5 27·5	5 28·4	5 12·6	5·0	1·8	11·0	3·9	17·0	6·1
51	5 27·8	5 28·6	5 12·8	5·1	1·8	11·1	4·0	17·1	6·1
52	5 28·0	5 28·9	5 13·1	5·2	1·9	11·2	4·0	17·2	6·2
53	5 28·3	5 29·1	5 13·3	5·3	1·9	11·3	4·0	17·3	6·2
54	5 28·5	5 29·4	5 13·5	5·4	1·9	11·4	4·1	17·4	6·2
55	5 28·8	5 29·7	5 13·8	5·5	2·0	11·5	4·1	17·5	6·3
56	5 29·0	5 29·9	5 14·0	5·6	2·0	11·6	4·2	17·6	6·3
57	5 29·3	5 30·2	5 14·3	5·7	2·0	11·7	4·2	17·7	6·3
58	5 29·5	5 30·4	5 14·5	5·8	2·1	11·8	4·2	17·8	6·4
59	5 29·8	5 30·7	5 14·7	5·9	2·1	11·9	4·3	17·9	6·4
60	5 30·0	5 30·9	5 15·0	6·0	2·2	12·0	4·3	18·0	6·5

m 22	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	5 30·0	5 30·9	5 15·0	0·0	0·0	6·0	2·3	12·0	4·5
01	5 30·3	5 31·2	5 15·2	0·1	0·0	6·1	2·3	12·1	4·5
02	5 30·5	5 31·4	5 15·4	0·2	0·1	6·2	2·3	12·2	4·6
03	5 30·8	5 31·7	5 15·7	0·3	0·1	6·3	2·4	12·3	4·6
04	5 31·0	5 31·9	5 15·9	0·4	0·2	6·4	2·4	12·4	4·7
05	5 31·3	5 32·2	5 16·2	0·5	0·2	6·5	2·4	12·5	4·7
06	5 31·5	5 32·4	5 16·4	0·6	0·2	6·6	2·5	12·6	4·7
07	5 31·8	5 32·7	5 16·6	0·7	0·3	6·7	2·5	12·7	4·8
08	5 32·0	5 32·9	5 16·9	0·8	0·3	6·8	2·6	12·8	4·8
09	5 32·3	5 33·2	5 17·1	0·9	0·3	6·9	2·6	12·9	4·8
10	5 32·5	5 33·4	5 17·4	1·0	0·4	7·0	2·6	13·0	4·9
11	5 32·8	5 33·7	5 17·6	1·1	0·4	7·1	2·7	13·1	4·9
12	5 33·0	5 33·9	5 17·8	1·2	0·5	7·2	2·7	13·2	5·0
13	5 33·3	5 34·2	5 18·1	1·3	0·5	7·3	2·7	13·3	5·0
14	5 33·5	5 34·4	5 18·3	1·4	0·5	7·4	2·8	13·4	5·0
15	5 33·8	5 34·7	5 18·5	1·5	0·6	7·5	2·8	13·5	5·1
16	5 34·0	5 34·9	5 18·8	1·6	0·6	7·6	2·9	13·6	5·1
17	5 34·3	5 35·2	5 19·0	1·7	0·6	7·7	2·9	13·7	5·1
18	5 34·5	5 35·4	5 19·3	1·8	0·7	7·8	2·9	13·8	5·2
19	5 34·8	5 35·7	5 19·5	1·9	0·7	7·9	3·0	13·9	5·2
20	5 35·0	5 35·9	5 19·7	2·0	0·8	8·0	3·0	14·0	5·3
21	5 35·3	5 36·2	5 20·0	2·1	0·8	8·1	3·0	14·1	5·3
22	5 35·5	5 36·4	5 20·2	2·2	0·8	8·2	3·1	14·2	5·3
23	5 35·8	5 36·7	5 20·5	2·3	0·9	8·3	3·1	14·3	5·4
24	5 36·0	5 36·9	5 20·7	2·4	0·9	8·4	3·2	14·4	5·4
25	5 36·3	5 37·2	5 20·9	2·5	0·9	8·5	3·2	14·5	5·4
26	5 36·5	5 37·4	5 21·2	2·6	1·0	8·6	3·2	14·6	5·5
27	5 36·8	5 37·7	5 21·4	2·7	1·0	8·7	3·3	14·7	5·5
28	5 37·0	5 37·9	5 21·6	2·8	1·0	8·8	3·3	14·8	5·6
29	5 37·3	5 38·2	5 21·9	2·9	1·1	8·9	3·3	14·9	5·6
30	5 37·5	5 38·4	5 22·1	3·0	1·1	9·0	3·4	15·0	5·6
31	5 37·8	5 38·7	5 22·4	3·1	1·2	9·1	3·4	15·1	5·7
32	5 38·0	5 38·9	5 22·6	3·2	1·2	9·2	3·5	15·2	5·7
33	5 38·3	5 39·2	5 22·8	3·3	1·2	9·3	3·5	15·3	5·7
34	5 38·5	5 39·4	5 23·1	3·4	1·3	9·4	3·5	15·4	5·8
35	5 38·8	5 39·7	5 23·3	3·5	1·3	9·5	3·6	15·5	5·8
36	5 39·0	5 39·9	5 23·6	3·6	1·4	9·6	3·6	15·6	5·9
37	5 39·3	5 40·2	5 23·8	3·7	1·4	9·7	3·6	15·7	5·9
38	5 39·5	5 40·4	5 24·0	3·8	1·4	9·8	3·7	15·8	5·9
39	5 39·8	5 40·7	5 24·3	3·9	1·5	9·9	3·7	15·9	6·0
40	5 40·0	5 40·9	5 24·5	4·0	1·5	10·0	3·8	16·0	6·0
41	5 40·3	5 41·2	5 24·7	4·1	1·5	10·1	3·8	16·1	6·0
42	5 40·5	5 41·4	5 25·0	4·2	1·6	10·2	3·8	16·2	6·1
43	5 40·8	5 41·7	5 25·2	4·3	1·6	10·3	3·9	16·3	6·1
44	5 41·0	5 41·9	5 25·5	4·4	1·7	10·4	3·9	16·4	6·1
45	5 41·3	5 42·2	5 25·7	4·5	1·7	10·5	3·9	16·5	6·2
46	5 41·5	5 42·4	5 25·9	4·6	1·7	10·6	4·0	16·6	6·2
47	5 41·8	5 42·7	5 26·2	4·7	1·8	10·7	4·0	16·7	6·3
48	5 42·0	5 42·9	5 26·4	4·8	1·8	10·8	4·1	16·8	6·3
49	5 42·3	5 43·2	5 26·7	4·9	1·8	10·9	4·1	16·9	6·3
50	5 42·5	5 43·4	5 26·9	5·0	1·9	11·0	4·1	17·0	6·4
51	5 42·8	5 43·7	5 27·1	5·1	1·9	11·1	4·2	17·1	6·4
52	5 43·0	5 43·9	5 27·4	5·2	2·0	11·2	4·2	17·2	6·5
53	5 43·3	5 44·2	5 27·6	5·3	2·0	11·3	4·2	17·3	6·5
54	5 43·5	5 44·4	5 27·9	5·4	2·0	11·4	4·3	17·4	6·5
55	5 43·8	5 44·7	5 28·1	5·5	2·1	11·5	4·3	17·5	6·6
56	5 44·0	5 44·9	5 28·3	5·6	2·1	11·6	4·4	17·6	6·6
57	5 44·3	5 45·2	5 28·6	5·7	2·1	11·7	4·4	17·7	6·6
58	5 44·5	5 45·4	5 28·8	5·8	2·2	11·8	4·4	17·8	6·7
59	5 44·8	5 45·7	5 29·0	5·9	2·2	11·9	4·5	17·9	6·7
60	5 45·0	5 45·9	5 29·3	6·0	2·3	12·0	4·5	18·0	6·8

m 23	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	5 45·0	5 45·9	5 29·3	0·0	0·0	6·0	2·4	12·0	4·7
01	5 45·3	5 46·2	5 29·5	0·1	0·0	6·1	2·4	12·1	4·7
02	5 45·5	5 46·4	5 29·8	0·2	0·1	6·2	2·4	12·2	4·8
03	5 45·8	5 46·7	5 30·0	0·3	0·1	6·3	2·5	12·3	4·8
04	5 46·0	5 46·9	5 30·2	0·4	0·2	6·4	2·5	12·4	4·9
05	5 46·3	5 47·2	5 30·5	0·5	0·2	6·5	2·5	12·5	4·9
06	5 46·5	5 47·4	5 30·7	0·6	0·2	6·6	2·6	12·6	4·9
07	5 46·8	5 47·7	5 31·0	0·7	0·3	6·7	2·6	12·7	5·0
08	5 47·0	5 48·0	5 31·2	0·8	0·3	6·8	2·7	12·8	5·0
09	5 47·3	5 48·2	5 31·4	0·9	0·4	6·9	2·7	12·9	5·1
10	5 47·5	5 48·5	5 31·7	1·0	0·4	7·0	2·7	13·0	5·1
11	5 47·8	5 48·7	5 31·9	1·1	0·4	7·1	2·8	13·1	5·1
12	5 48·0	5 49·0	5 32·1	1·2	0·5	7·2	2·8	13·2	5·2
13	5 48·3	5 49·2	5 32·4	1·3	0·5	7·3	2·9	13·3	5·2
14	5 48·5	5 49·5	5 32·6	1·4	0·5	7·4	2·9	13·4	5·2
15	5 48·8	5 49·7	5 32·9	1·5	0·6	7·5	2·9	13·5	5·3
16	5 49·0	5 50·0	5 33·1	1·6	0·6	7·6	3·0	13·6	5·3
17	5 49·3	5 50·2	5 33·3	1·7	0·7	7·7	3·0	13·7	5·4
18	5 49·5	5 50·5	5 33·6	1·8	0·7	7·8	3·1	13·8	5·4
19	5 49·8	5 50·7	5 33·8	1·9	0·7	7·9	3·1	13·9	5·4
20	5 50·0	5 51·0	5 34·1	2·0	0·8	8·0	3·1	14·0	5·5
21	5 50·3	5 51·2	5 34·3	2·1	0·8	8·1	3·2	14·1	5·5
22	5 50·5	5 51·5	5 34·5	2·2	0·9	8·2	3·2	14·2	5·6
23	5 50·8	5 51·7	5 34·8	2·3	0·9	8·3	3·3	14·3	5·6
24	5 51·0	5 52·0	5 35·0	2·4	0·9	8·4	3·3	14·4	5·6
25	5 51·3	5 52·2	5 35·2	2·5	1·0	8·5	3·3	14·5	5·7
26	5 51·5	5 52·5	5 35·5	2·6	1·0	8·6	3·4	14·6	5·7
27	5 51·8	5 52·7	5 35·7	2·7	1·1	8·7	3·4	14·7	5·8
28	5 52·0	5 53·0	5 36·0	2·8	1·1	8·8	3·4	14·8	5·8
29	5 52·3	5 53·2	5 36·2	2·9	1·1	8·9	3·5	14·9	5·8
30	5 52·5	5 53·5	5 36·4	3·0	1·2	9·0	3·5	15·0	5·9
31	5 52·8	5 53·7	5 36·7	3·1	1·2	9·1	3·6	15·1	5·9
32	5 53·0	5 54·0	5 36·9	3·2	1·3	9·2	3·6	15·2	6·0
33	5 53·3	5 54·2	5 37·2	3·3	1·3	9·3	3·6	15·3	6·0
34	5 53·5	5 54·5	5 37·4	3·4	1·3	9·4	3·7	15·4	6·0
35	5 53·8	5 54·7	5 37·6	3·5	1·4	9·5	3·7	15·5	6·1
36	5 54·0	5 55·0	5 37·9	3·6	1·4	9·6	3·8	15·6	6·1
37	5 54·3	5 55·2	5 38·1	3·7	1·4	9·7	3·8	15·7	6·1
38	5 54·5	5 55·5	5 38·4	3·8	1·5	9·8	3·8	15·8	6·2
39	5 54·8	5 55·7	5 38·6	3·9	1·5	9·9	3·9	15·9	6·2
40	5 55·0	5 56·0	5 38·8	4·0	1·6	10·0	3·9	16·0	6·3
41	5 55·3	5 56·2	5 39·1	4·1	1·6	10·1	4·0	16·1	6·3
42	5 55·5	5 56·5	5 39·3	4·2	1·6	10·2	4·0	16·2	6·3
43	5 55·8	5 56·7	5 39·5	4·3	1·7	10·3	4·0	16·3	6·4
44	5 56·0	5 57·0	5 39·8	4·4	1·7	10·4	4·1	16·4	6·4
45	5 56·3	5 57·2	5 40·0	4·5	1·8	10·5	4·1	16·5	6·5
46	5 56·5	5 57·5	5 40·3	4·6	1·8	10·6	4·2	16·6	6·5
47	5 56·8	5 57·7	5 40·5	4·7	1·8	10·7	4·2	16·7	6·5
48	5 57·0	5 58·0	5 40·7	4·8	1·9	10·8	4·2	16·8	6·6
49	5 57·3	5 58·2	5 41·0	4·9	1·9	10·9	4·3	16·9	6·6
50	5 57·5	5 58·5	5 41·2	5·0	2·0	11·0	4·3	17·0	6·7
51	5 57·8	5 58·7	5 41·5	5·1	2·0	11·1	4·3	17·1	6·7
52	5 58·0	5 59·0	5 41·7	5·2	2·0	11·2	4·4	17·2	6·7
53	5 58·3	5 59·2	5 41·9	5·3	2·1	11·3	4·4	17·3	6·8
54	5 58·5	5 59·5	5 42·2	5·4	2·1	11·4	4·5	17·4	6·8
55	5 58·8	5 59·7	5 42·4	5·5	2·2	11·5	4·5	17·5	6·9
56	5 59·0	6 00·0	5 42·6	5·6	2·2	11·6	4·5	17·6	6·9
57	5 59·3	6 00·2	5 42·9	5·7	2·2	11·7	4·6	17·7	6·9
58	5 59·5	6 00·5	5 43·1	5·8	2·3	11·8	4·6	17·8	7·0
59	5 59·8	6 00·7	5 43·4	5·9	2·3	11·9	4·7	17·9	7·0
60	6 00·0	6 01·0	5 43·6	6·0	2·4	12·0	4·7	18·0	7·1

m 24	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	6 00·0	6 01·0	5 43·6	0·0	0·0	6·0	2·5	12·0	4·9
01	6 00·3	6 01·2	5 43·8	0·1	0·0	6·1	2·5	12·1	4·9
02	6 00·5	6 01·5	5 44·1	0·2	0·1	6·2	2·5	12·2	5·0
03	6 00·8	6 01·7	5 44·3	0·3	0·1	6·3	2·6	12·3	5·0
04	6 01·0	6 02·0	5 44·6	0·4	0·2	6·4	2·6	12·4	5·1
05	6 01·3	6 02·2	5 44·8	0·5	0·2	6·5	2·7	12·5	5·1
06	6 01·5	6 02·5	5 45·0	0·6	0·2	6·6	2·7	12·6	5·1
07	6 01·8	6 02·7	5 45·3	0·7	0·3	6·7	2·7	12·7	5·2
08	6 02·0	6 03·0	5 45·5	0·8	0·3	6·8	2·8	12·8	5·2
09	6 02·3	6 03·2	5 45·7	0·9	0·4	6·9	2·8	12·9	5·3
10	6 02·5	6 03·5	5 46·0	1·0	0·4	7·0	2·9	13·0	5·3
11	6 02·8	6 03·7	5 46·2	1·1	0·4	7·1	2·9	13·1	5·3
12	6 03·0	6 04·0	5 46·5	1·2	0·5	7·2	2·9	13·2	5·4
13	6 03·3	6 04·2	5 46·7	1·3	0·5	7·3	3·0	13·3	5·4
14	6 03·5	6 04·5	5 46·9	1·4	0·6	7·4	3·0	13·4	5·5
15	6 03·8	6 04·7	5 47·2	1·5	0·6	7·5	3·1	13·5	5·5
16	6 04·0	6 05·0	5 47·4	1·6	0·7	7·6	3·1	13·6	5·6
17	6 04·3	6 05·2	5 47·7	1·7	0·7	7·7	3·1	13·7	5·6
18	6 04·5	6 05·5	5 47·9	1·8	0·7	7·8	3·2	13·8	5·6
19	6 04·8	6 05·7	5 48·1	1·9	0·8	7·9	3·2	13·9	5·7
20	6 05·0	6 06·0	5 48·4	2·0	0·8	8·0	3·3	14·0	5·7
21	6 05·3	6 06·3	5 48·6	2·1	0·9	8·1	3·3	14·1	5·8
22	6 05·5	6 06·5	5 48·8	2·2	0·9	8·2	3·3	14·2	5·8
23	6 05·8	6 06·8	5 49·1	2·3	0·9	8·3	3·4	14·3	5·8
24	6 06·0	6 07·0	5 49·3	2·4	1·0	8·4	3·4	14·4	5·9
25	6 06·3	6 07·3	5 49·6	2·5	1·0	8·5	3·5	14·5	5·9
26	6 06·5	6 07·5	5 49·8	2·6	1·1	8·6	3·5	14·6	6·0
27	6 06·8	6 07·8	5 50·0	2·7	1·1	8·7	3·6	14·7	6·0
28	6 07·0	6 08·0	5 50·3	2·8	1·1	8·8	3·6	14·8	6·0
29	6 07·3	6 08·3	5 50·5	2·9	1·2	8·9	3·6	14·9	6·1
30	6 07·5	6 08·5	5 50·8	3·0	1·2	9·0	3·7	15·0	6·1
31	6 07·8	6 08·8	5 51·0	3·1	1·3	9·1	3·7	15·1	6·2
32	6 08·0	6 09·0	5 51·2	3·2	1·3	9·2	3·8	15·2	6·2
33	6 08·3	6 09·3	5 51·5	3·3	1·3	9·3	3·8	15·3	6·2
34	6 08·5	6 09·5	5 51·7	3·4	1·4	9·4	3·8	15·4	6·3
35	6 08·8	6 09·8	5 52·0	3·5	1·4	9·5	3·9	15·5	6·3
36	6 09·0	6 10·0	5 52·2	3·6	1·5	9·6	3·9	15·6	6·4
37	6 09·3	6 10·3	5 52·4	3·7	1·5	9·7	4·0	15·7	6·4
38	6 09·5	6 10·5	5 52·7	3·8	1·6	9·8	4·0	15·8	6·5
39	6 09·8	6 10·8	5 52·9	3·9	1·6	9·9	4·0	15·9	6·5
40	6 10·0	6 11·0	5 53·1	4·0	1·6	10·0	4·1	16·0	6·5
41	6 10·3	6 11·3	5 53·4	4·1	1·7	10·1	4·1	16·1	6·6
42	6 10·5	6 11·5	5 53·6	4·2	1·7	10·2	4·2	16·2	6·6
43	6 10·8	6 11·8	5 53·9	4·3	1·8	10·3	4·2	16·3	6·7
44	6 11·0	6 12·0	5 54·1	4·4	1·8	10·4	4·2	16·4	6·7
45	6 11·3	6 12·3	5 54·3	4·5	1·8	10·5	4·3	16·5	6·7
46	6 11·5	6 12·5	5 54·6	4·6	1·9	10·6	4·3	16·6	6·8
47	6 11·8	6 12·8	5 54·8	4·7	1·9	10·7	4·4	16·7	6·8
48	6 12·0	6 13·0	5 55·1	4·8	2·0	10·8	4·4	16·8	6·9
49	6 12·3	6 13·3	5 55·3	4·9	2·0	10·9	4·5	16·9	6·9
50	6 12·5	6 13·5	5 55·5	5·0	2·0	11·0	4·5	17·0	6·9
51	6 12·8	6 13·8	5 55·8	5·1	2·1	11·1	4·5	17·1	7·0
52	6 13·0	6 14·0	5 56·0	5·2	2·1	11·2	4·6	17·2	7·0
53	6 13·3	6 14·3	5 56·2	5·3	2·2	11·3	4·6	17·3	7·1
54	6 13·5	6 14·5	5 56·5	5·4	2·2	11·4	4·7	17·4	7·1
55	6 13·8	6 14·8	5 56·7	5·5	2·2	11·5	4·7	17·5	7·1
56	6 14·0	6 15·0	5 57·0	5·6	2·3	11·6	4·7	17·6	7·2
57	6 14·3	6 15·3	5 57·2	5·7	2·3	11·7	4·8	17·7	7·2
58	6 14·5	6 15·5	5 57·4	5·8	2·4	11·8	4·8	17·8	7·3
59	6 14·8	6 15·8	5 57·7	5·9	2·4	11·9	4·9	17·9	7·3
60	6 15·0	6 16·0	5 57·9	6·0	2·5	12·0	4·9	18·0	7·4

m 25	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	6 15·0	6 16·0	5 57·9	0·0	0·0	6·0	2·6	12·0	5·1
01	6 15·3	6 16·3	5 58·2	0·1	0·0	6·1	2·6	12·1	5·1
02	6 15·5	6 16·5	5 58·4	0·2	0·1	6·2	2·6	12·2	5·2
03	6 15·8	6 16·8	5 58·6	0·3	0·1	6·3	2·7	12·3	5·2
04	6 16·0	6 17·0	5 58·9	0·4	0·2	6·4	2·7	12·4	5·3
05	6 16·3	6 17·3	5 59·1	0·5	0·2	6·5	2·8	12·5	5·3
06	6 16·5	6 17·5	5 59·3	0·6	0·3	6·6	2·8	12·6	5·4
07	6 16·8	6 17·8	5 59·6	0·7	0·3	6·7	2·8	12·7	5·4
08	6 17·0	6 18·0	5 59·8	0·8	0·3	6·8	2·9	12·8	5·4
09	6 17·3	6 18·3	6 00·1	0·9	0·4	6·9	2·9	12·9	5·5
10	6 17·5	6 18·5	6 00·3	1·0	0·4	7·0	3·0	13·0	5·5
11	6 17·8	6 18·8	6 00·5	1·1	0·5	7·1	3·0	13·1	5·6
12	6 18·0	6 19·0	6 00·8	1·2	0·5	7·2	3·1	13·2	5·6
13	6 18·3	6 19·3	6 01·0	1·3	0·6	7·3	3·1	13·3	5·7
14	6 18·5	6 19·5	6 01·3	1·4	0·6	7·4	3·1	13·4	5·7
15	6 18·8	6 19·8	6 01·5	1·5	0·6	7·5	3·2	13·5	5·7
16	6 19·0	6 20·0	6 01·7	1·6	0·7	7·6	3·2	13·6	5·8
17	6 19·3	6 20·3	6 02·0	1·7	0·7	7·7	3·3	13·7	5·8
18	6 19·5	6 20·5	6 02·2	1·8	0·8	7·8	3·3	13·8	5·9
19	6 19·8	6 20·8	6 02·5	1·9	0·8	7·9	3·4	13·9	5·9
20	6 20·0	6 21·0	6 02·7	2·0	0·9	8·0	3·4	14·0	6·0
21	6 20·3	6 21·3	6 02·9	2·1	0·9	8·1	3·4	14·1	6·0
22	6 20·5	6 21·5	6 03·2	2·2	0·9	8·2	3·5	14·2	6·0
23	6 20·8	6 21·8	6 03·4	2·3	1·0	8·3	3·5	14·3	6·1
24	6 21·0	6 22·0	6 03·6	2·4	1·0	8·4	3·6	14·4	6·1
25	6 21·3	6 22·3	6 03·9	2·5	1·1	8·5	3·6	14·5	6·2
26	6 21·5	6 22·5	6 04·1	2·6	1·1	8·6	3·7	14·6	6·2
27	6 21·8	6 22·8	6 04·4	2·7	1·1	8·7	3·7	14·7	6·2
28	6 22·0	6 23·0	6 04·6	2·8	1·2	8·8	3·7	14·8	6·3
29	6 22·3	6 23·3	6 04·8	2·9	1·2	8·9	3·8	14·9	6·3
30	6 22·5	6 23·5	6 05·1	3·0	1·3	9·0	3·8	15·0	6·4
31	6 22·8	6 23·8	6 05·3	3·1	1·3	9·1	3·9	15·1	6·4
32	6 23·0	6 24·0	6 05·6	3·2	1·4	9·2	3·9	15·2	6·5
33	6 23·3	6 24·3	6 05·8	3·3	1·4	9·3	4·0	15·3	6·5
34	6 23·5	6 24·5	6 06·0	3·4	1·4	9·4	4·0	15·4	6·5
35	6 23·8	6 24·8	6 06·3	3·5	1·5	9·5	4·0	15·5	6·6
36	6 24·0	6 25·1	6 06·5	3·6	1·5	9·6	4·1	15·6	6·6
37	6 24·3	6 25·3	6 06·7	3·7	1·6	9·7	4·1	15·7	6·7
38	6 24·5	6 25·6	6 07·0	3·8	1·6	9·8	4·2	15·8	6·7
39	6 24·8	6 25·8	6 07·2	3·9	1·7	9·9	4·2	15·9	6·8
40	6 25·0	6 26·1	6 07·5	4·0	1·7	10·0	4·3	16·0	6·8
41	6 25·3	6 26·3	6 07·7	4·1	1·7	10·1	4·3	16·1	6·8
42	6 25·5	6 26·6	6 07·9	4·2	1·8	10·2	4·3	16·2	6·9
43	6 25·8	6 26·8	6 08·2	4·3	1·8	10·3	4·4	16·3	6·9
44	6 26·0	6 27·1	6 08·4	4·4	1·9	10·4	4·4	16·4	7·0
45	6 26·3	6 27·3	6 08·7	4·5	1·9	10·5	4·5	16·5	7·0
46	6 26·5	6 27·6	6 08·9	4·6	2·0	10·6	4·5	16·6	7·1
47	6 26·8	6 27·8	6 09·1	4·7	2·0	10·7	4·5	16·7	7·1
48	6 27·0	6 28·1	6 09·4	4·8	2·0	10·8	4·6	16·8	7·1
49	6 27·3	6 28·3	6 09·6	4·9	2·1	10·9	4·6	16·9	7·2
50	6 27·5	6 28·6	6 09·8	5·0	2·1	11·0	4·7	17·0	7·2
51	6 27·8	6 28·8	6 10·1	5·1	2·2	11·1	4·7	17·1	7·3
52	6 28·0	6 29·1	6 10·3	5·2	2·2	11·2	4·8	17·2	7·3
53	6 28·3	6 29·3	6 10·6	5·3	2·3	11·3	4·8	17·3	7·4
54	6 28·5	6 29·6	6 10·8	5·4	2·3	11·4	4·8	17·4	7·4
55	6 28·8	6 29·8	6 11·0	5·5	2·3	11·5	4·9	17·5	7·4
56	6 29·0	6 30·1	6 11·3	5·6	2·4	11·6	4·9	17·6	7·5
57	6 29·3	6 30·3	6 11·5	5·7	2·4	11·7	5·0	17·7	7·5
58	6 29·5	6 30·6	6 11·8	5·8	2·5	11·8	5·0	17·8	7·6
59	6 29·8	6 30·8	6 12·0	5·9	2·5	11·9	5·1	17·9	7·6
60	6 30·0	6 31·1	6 12·2	6·0	2·6	12·0	5·1	18·0	7·7

m 26	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	6 30·0	6 31·1	6 12·2	0·0	0·0	6·0	2·7	12·0	5·3
01	6 30·3	6 31·3	6 12·5	0·1	0·0	6·1	2·7	12·1	5·3
02	6 30·5	6 31·6	6 12·7	0·2	0·1	6·2	2·7	12·2	5·4
03	6 30·8	6 31·8	6 12·9	0·3	0·1	6·3	2·8	12·3	5·4
04	6 31·0	6 32·1	6 13·2	0·4	0·2	6·4	2·8	12·4	5·5
05	6 31·3	6 32·3	6 13·4	0·5	0·2	6·5	2·9	12·5	5·5
06	6 31·5	6 32·6	6 13·7	0·6	0·3	6·6	2·9	12·6	5·6
07	6 31·8	6 32·8	6 13·9	0·7	0·3	6·7	3·0	12·7	5·6
08	6 32·0	6 33·1	6 14·1	0·8	0·4	6·8	3·0	12·8	5·7
09	6 32·3	6 33·3	6 14·4	0·9	0·4	6·9	3·0	12·9	5·7
10	6 32·5	6 33·6	6 14·6	1·0	0·4	7·0	3·1	13·0	5·7
11	6 32·8	6 33·8	6 14·9	1·1	0·5	7·1	3·1	13·1	5·8
12	6 33·0	6 34·1	6 15·1	1·2	0·5	7·2	3·2	13·2	5·8
13	6 33·3	6 34·3	6 15·3	1·3	0·6	7·3	3·2	13·3	5·9
14	6 33·5	6 34·6	6 15·6	1·4	0·6	7·4	3·3	13·4	5·9
15	6 33·8	6 34·8	6 15·8	1·5	0·7	7·5	3·3	13·5	6·0
16	6 34·0	6 35·1	6 16·1	1·6	0·7	7·6	3·4	13·6	6·0
17	6 34·3	6 35·3	6 16·3	1·7	0·8	7·7	3·4	13·7	6·1
18	6 34·5	6 35·6	6 16·5	1·8	0·8	7·8	3·4	13·8	6·1
19	6 34·8	6 35·8	6 16·8	1·9	0·8	7·9	3·5	13·9	6·1
20	6 35·0	6 36·1	6 17·0	2·0	0·9	8·0	3·5	14·0	6·2
21	6 35·3	6 36·3	6 17·2	2·1	0·9	8·1	3·6	14·1	6·2
22	6 35·5	6 36·6	6 17·5	2·2	1·0	8·2	3·6	14·2	6·3
23	6 35·8	6 36·8	6 17·7	2·3	1·0	8·3	3·7	14·3	6·3
24	6 36·0	6 37·1	6 18·0	2·4	1·1	8·4	3·7	14·4	6·4
25	6 36·3	6 37·3	6 18·2	2·5	1·1	8·5	3·8	14·5	6·4
26	6 36·5	6 37·6	6 18·4	2·6	1·1	8·6	3·8	14·6	6·4
27	6 36·8	6 37·8	6 18·7	2·7	1·2	8·7	3·8	14·7	6·5
28	6 37·0	6 38·1	6 18·9	2·8	1·2	8·8	3·9	14·8	6·5
29	6 37·3	6 38·3	6 19·2	2·9	1·3	8·9	3·9	14·9	6·6
30	6 37·5	6 38·6	6 19·4	3·0	1·3	9·0	4·0	15·0	6·6
31	6 37·8	6 38·8	6 19·6	3·1	1·4	9·1	4·0	15·1	6·7
32	6 38·0	6 39·1	6 19·9	3·2	1·4	9·2	4·1	15·2	6·7
33	6 38·3	6 39·3	6 20·1	3·3	1·5	9·3	4·1	15·3	6·8
34	6 38·5	6 39·6	6 20·3	3·4	1·5	9·4	4·2	15·4	6·8
35	6 38·8	6 39·8	6 20·6	3·5	1·5	9·5	4·2	15·5	6·8
36	6 39·0	6 40·1	6 20·8	3·6	1·6	9·6	4·2	15·6	6·9
37	6 39·3	6 40·3	6 21·1	3·7	1·6	9·7	4·3	15·7	6·9
38	6 39·5	6 40·6	6 21·3	3·8	1·7	9·8	4·3	15·8	7·0
39	6 39·8	6 40·8	6 21·5	3·9	1·7	9·9	4·4	15·9	7·0
40	6 40·0	6 41·1	6 21·8	4·0	1·8	10·0	4·4	16·0	7·1
41	6 40·3	6 41·3	6 22·0	4·1	1·8	10·1	4·5	16·1	7·1
42	6 40·5	6 41·6	6 22·3	4·2	1·9	10·2	4·5	16·2	7·2
43	6 40·8	6 41·8	6 22·5	4·3	1·9	10·3	4·5	16·3	7·2
44	6 41·0	6 42·1	6 22·7	4·4	1·9	10·4	4·6	16·4	7·2
45	6 41·3	6 42·3	6 23·0	4·5	2·0	10·5	4·6	16·5	7·3
46	6 41·5	6 42·6	6 23·2	4·6	2·0	10·6	4·7	16·6	7·3
47	6 41·8	6 42·8	6 23·4	4·7	2·1	10·7	4·7	16·7	7·4
48	6 42·0	6 43·1	6 23·7	4·8	2·1	10·8	4·8	16·8	7·4
49	6 42·3	6 43·4	6 23·9	4·9	2·2	10·9	4·8	16·9	7·5
50	6 42·5	6 43·6	6 24·2	5·0	2·2	11·0	4·9	17·0	7·5
51	6 42·8	6 43·9	6 24·4	5·1	2·3	11·1	4·9	17·1	7·6
52	6 43·0	6 44·1	6 24·6	5·2	2·3	11·2	4·9	17·2	7·6
53	6 43·3	6 44·4	6 24·9	5·3	2·3	11·3	5·0	17·3	7·6
54	6 43·5	6 44·6	6 25·1	5·4	2·4	11·4	5·0	17·4	7·7
55	6 43·8	6 44·9	6 25·4	5·5	2·4	11·5	5·1	17·5	7·7
56	6 44·0	6 45·1	6 25·6	5·6	2·5	11·6	5·1	17·6	7·8
57	6 44·3	6 45·4	6 25·8	5·7	2·5	11·7	5·2	17·7	7·8
58	6 44·5	6 45·6	6 26·1	5·8	2·6	11·8	5·2	17·8	7·9
59	6 44·8	6 45·9	6 26·3	5·9	2·6	11·9	5·3	17·9	7·9
60	6 45·0	6 46·1	6 26·6	6·0	2·7	12·0	5·3	18·0	8·0

m 27	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	6 45·0	6 46·1	6 26·6	0·0	0·0	6·0	2·8	12·0	5·5
01	6 45·3	6 46·4	6 26·8	0·1	0·0	6·1	2·8	12·1	5·5
02	6 45·5	6 46·6	6 27·0	0·2	0·1	6·2	2·8	12·2	5·6
03	6 45·8	6 46·9	6 27·3	0·3	0·1	6·3	2·9	12·3	5·6
04	6 46·0	6 47·1	6 27·5	0·4	0·2	6·4	2·9	12·4	5·7
05	6 46·3	6 47·4	6 27·7	0·5	0·2	6·5	3·0	12·5	5·7
06	6 46·5	6 47·6	6 28·0	0·6	0·3	6·6	3·0	12·6	5·8
07	6 46·8	6 47·9	6 28·2	0·7	0·3	6·7	3·1	12·7	5·8
08	6 47·0	6 48·1	6 28·5	0·8	0·4	6·8	3·1	12·8	5·9
09	6 47·3	6 48·4	6 28·7	0·9	0·4	6·9	3·2	12·9	5·9
10	6 47·5	6 48·6	6 28·9	1·0	0·5	7·0	3·2	13·0	6·0
11	6 47·8	6 48·9	6 29·2	1·1	0·5	7·1	3·3	13·1	6·0
12	6 48·0	6 49·1	6 29·4	1·2	0·6	7·2	3·3	13·2	6·1
13	6 48·3	6 49·4	6 29·7	1·3	0·6	7·3	3·3	13·3	6·1
14	6 48·5	6 49·6	6 29·9	1·4	0·6	7·4	3·4	13·4	6·1
15	6 48·8	6 49·9	6 30·1	1·5	0·7	7·5	3·4	13·5	6·2
16	6 49·0	6 50·1	6 30·4	1·6	0·7	7·6	3·5	13·6	6·2
17	6 49·3	6 50·4	6 30·6	1·7	0·8	7·7	3·5	13·7	6·3
18	6 49·5	6 50·6	6 30·8	1·8	0·8	7·8	3·6	13·8	6·3
19	6 49·8	6 50·9	6 31·1	1·9	0·9	7·9	3·6	13·9	6·4
20	6 50·0	6 51·1	6 31·3	2·0	0·9	8·0	3·7	14·0	6·4
21	6 50·3	6 51·4	6 31·6	2·1	1·0	8·1	3·7	14·1	6·5
22	6 50·5	6 51·6	6 31·8	2·2	1·0	8·2	3·8	14·2	6·5
23	6 50·8	6 51·9	6 32·0	2·3	1·1	8·3	3·8	14·3	6·6
24	6 51·0	6 52·1	6 32·3	2·4	1·1	8·4	3·9	14·4	6·6
25	6 51·3	6 52·4	6 32·5	2·5	1·1	8·5	3·9	14·5	6·6
26	6 51·5	6 52·6	6 32·8	2·6	1·2	8·6	3·9	14·6	6·7
27	6 51·8	6 52·9	6 33·0	2·7	1·2	8·7	4·0	14·7	6·7
28	6 52·0	6 53·1	6 33·2	2·8	1·3	8·8	4·0	14·8	6·8
29	6 52·3	6 53·4	6 33·5	2·9	1·3	8·9	4·1	14·9	6·8
30	6 52·5	6 53·6	6 33·7	3·0	1·4	9·0	4·1	15·0	6·9
31	6 52·8	6 53·9	6 33·9	3·1	1·4	9·1	4·2	15·1	6·9
32	6 53·0	6 54·1	6 34·2	3·2	1·5	9·2	4·2	15·2	7·0
33	6 53·3	6 54·4	6 34·4	3·3	1·5	9·3	4·3	15·3	7·0
34	6 53·5	6 54·6	6 34·7	3·4	1·6	9·4	4·3	15·4	7·1
35	6 53·8	6 54·9	6 34·9	3·5	1·6	9·5	4·4	15·5	7·1
36	6 54·0	6 55·1	6 35·1	3·6	1·7	9·6	4·4	15·6	7·2
37	6 54·3	6 55·4	6 35·4	3·7	1·7	9·7	4·4	15·7	7·2
38	6 54·5	6 55·6	6 35·6	3·8	1·7	9·8	4·5	15·8	7·2
39	6 54·8	6 55·9	6 35·9	3·9	1·8	9·9	4·5	15·9	7·3
40	6 55·0	6 56·1	6 36·1	4·0	1·8	10·0	4·6	16·0	7·3
41	6 55·3	6 56·4	6 36·3	4·1	1·9	10·1	4·6	16·1	7·4
42	6 55·5	6 56·6	6 36·6	4·2	1·9	10·2	4·7	16·2	7·4
43	6 55·8	6 56·9	6 36·8	4·3	2·0	10·3	4·7	16·3	7·5
44	6 56·0	6 57·1	6 37·0	4·4	2·0	10·4	4·8	16·4	7·5
45	6 56·3	6 57·4	6 37·3	4·5	2·1	10·5	4·8	16·5	7·6
46	6 56·5	6 57·6	6 37·5	4·6	2·1	10·6	4·9	16·6	7·6
47	6 56·8	6 57·9	6 37·8	4·7	2·2	10·7	4·9	16·7	7·7
48	6 57·0	6 58·1	6 38·0	4·8	2·2	10·8	5·0	16·8	7·7
49	6 57·3	6 58·4	6 38·2	4·9	2·2	10·9	5·0	16·9	7·7
50	6 57·5	6 58·6	6 38·5	5·0	2·3	11·0	5·0	17·0	7·8
51	6 57·8	6 58·9	6 38·7	5·1	2·3	11·1	5·1	17·1	7·8
52	6 58·0	6 59·1	6 39·0	5·2	2·4	11·2	5·1	17·2	7·9
53	6 58·3	6 59·4	6 39·2	5·3	2·4	11·3	5·2	17·3	7·9
54	6 58·5	6 59·6	6 39·4	5·4	2·5	11·4	5·2	17·4	8·0
55	6 58·8	6 59·9	6 39·7	5·5	2·5	11·5	5·3	17·5	8·0
56	6 59·0	7 00·1	6 39·9	5·6	2·6	11·6	5·3	17·6	8·1
57	6 59·3	7 00·4	6 40·2	5·7	2·6	11·7	5·4	17·7	8·1
58	6 59·5	7 00·6	6 40·4	5·8	2·7	11·8	5·4	17·8	8·2
59	6 59·8	7 00·9	6 40·6	5·9	2·7	11·9	5·5	17·9	8·2
60	7 00·0	7 01·1	6 40·9	6·0	2·8	12·0	5·5	18·0	8·3

m 28	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	♃ ′	° ′	° ′	′	′	′	′	′	′
00	7 00·0	7 01·1	6 40·9	0·0	0·0	6·0	2·9	12·0	5·7
01	7 00·3	7 01·4	6 41·1	0·1	0·0	6·1	2·9	12·1	5·7
02	7 00·5	7 01·7	6 41·3	0·2	0·1	6·2	2·9	12·2	5·8
03	7 00·8	7 01·9	6 41·6	0·3	0·1	6·3	3·0	12·3	5·8
04	7 01·0	7 02·2	6 41·8	0·4	0·2	6·4	3·0	12·4	5·9
05	7 01·3	7 02·4	6 42·1	0·5	0·2	6·5	3·1	12·5	5·9
06	7 01·5	7 02·7	6 42·3	0·6	0·3	6·6	3·1	12·6	6·0
07	7 01·8	7 02·9	6 42·5	0·7	0·3	6·7	3·2	12·7	6·0
08	7 02·0	7 03·2	6 42·8	0·8	0·4	6·8	3·2	12·8	6·1
09	7 02·3	7 03·4	6 43·0	0·9	0·4	6·9	3·3	12·9	6·1
10	7 02·5	7 03·7	6 43·3	1·0	0·5	7·0	3·3	13·0	6·2
11	7 02·8	7 03·9	6 43·5	1·1	0·5	7·1	3·4	13·1	6·2
12	7 03·0	7 04·2	6 43·7	1·2	0·6	7·2	3·4	13·2	6·3
13	7 03·3	7 04·4	6 44·0	1·3	0·6	7·3	3·5	13·3	6·3
14	7 03·5	7 04·7	6 44·2	1·4	0·7	7·4	3·5	13·4	6·4
15	7 03·8	7 04·9	6 44·4	1·5	0·7	7·5	3·6	13·5	6·4
16	7 04·0	7 05·2	6 44·7	1·6	0·8	7·6	3·6	13·6	6·5
17	7 04·3	7 05·4	6 44·9	1·7	0·8	7·7	3·7	13·7	6·5
18	7 04·5	7 05·7	6 45·2	1·8	0·9	7·8	3·7	13·8	6·6
19	7 04·8	7 05·9	6 45·4	1·9	0·9	7·9	3·8	13·9	6·6
20	7 05·0	7 06·2	6 45·6	2·0	1·0	8·0	3·8	14·0	6·7
21	7 05·3	7 06·4	6 45·9	2·1	1·0	8·1	3·8	14·1	6·7
22	7 05·5	7 06·7	6 46·1	2·2	1·0	8·2	3·9	14·2	6·7
23	7 05·8	7 06·9	6 46·4	2·3	1·1	8·3	3·9	14·3	6·8
24	7 06·0	7 07·2	6 46·6	2·4	1·1	8·4	4·0	14·4	6·8
25	7 06·3	7 07·4	6 46·8	2·5	1·2	8·5	4·0	14·5	6·9
26	7 06·5	7 07·7	6 47·1	2·6	1·2	8·6	4·1	14·6	6·9
27	7 06·8	7 07·9	6 47·3	2·7	1·3	8·7	4·1	14·7	7·0
28	7 07·0	7 08·2	6 47·5	2·8	1·3	8·8	4·2	14·8	7·0
29	7 07·3	7 08·4	6 47·8	2·9	1·4	8·9	4·2	14·9	7·1
30	7 07·5	7 08·7	6 48·0	3·0	1·4	9·0	4·3	15·0	7·1
31	7 07·8	7 08·9	6 48·3	3·1	1·5	9·1	4·3	15·1	7·2
32	7 08·0	7 09·2	6 48·5	3·2	1·5	9·2	4·4	15·2	7·2
33	7 08·3	7 09·4	6 48·7	3·3	1·6	9·3	4·4	15·3	7·3
34	7 08·5	7 09·7	6 49·0	3·4	1·6	9·4	4·5	15·4	7·3
35	7 08·8	7 09·9	6 49·2	3·5	1·7	9·5	4·5	15·5	7·4
36	7 09·0	7 10·2	6 49·5	3·6	1·7	9·6	4·6	15·6	7·4
37	7 09·3	7 10·4	6 49·7	3·7	1·8	9·7	4·6	15·7	7·5
38	7 09·5	7 10·7	6 49·9	3·8	1·8	9·8	4·7	15·8	7·5
39	7 09·8	7 10·9	6 50·2	3·9	1·9	9·9	4·7	15·9	7·6
40	7 10·0	7 11·2	6 50·4	4·0	1·9	10·0	4·8	16·0	7·6
41	7 10·3	7 11·4	6 50·6	4·1	1·9	10·1	4·8	16·1	7·6
42	7 10·5	7 11·7	6 50·9	4·2	2·0	10·2	4·8	16·2	7·7
43	7 10·8	7 11·9	6 51·1	4·3	2·0	10·3	4·9	16·3	7·7
44	7 11·0	7 12·2	6 51·4	4·4	2·1	10·4	4·9	16·4	7·8
45	7 11·3	7 12·4	6 51·6	4·5	2·1	10·5	5·0	16·5	7·8
46	7 11·5	7 12·7	6 51·8	4·6	2·2	10·6	5·0	16·6	7·9
47	7 11·8	7 12·9	6 52·1	4·7	2·2	10·7	5·1	16·7	7·9
48	7 12·0	7 13·2	6 52·3	4·8	2·3	10·8	5·1	16·8	8·0
49	7 12·3	7 13·4	6 52·6	4·9	2·3	10·9	5·2	16·9	8·0
50	7 12·5	7 13·7	6 52·8	5·0	2·4	11·0	5·2	17·0	8·1
51	7 12·8	7 13·9	6 53·0	5·1	2·4	11·1	5·3	17·1	8·1
52	7 13·0	7 14·2	6 53·3	5·2	2·5	11·2	5·3	17·2	8·2
53	7 13·3	7 14·4	6 53·5	5·3	2·5	11·3	5·4	17·3	8·2
54	7 13·5	7 14·7	6 53·8	5·4	2·6	11·4	5·4	17·4	8·3
55	7 13·8	7 14·9	6 54·0	5·5	2·6	11·5	5·5	17·5	8·3
56	7 14·0	7 15·2	6 54·2	5·6	2·7	11·6	5·5	17·6	8·4
57	7 14·3	7 15·4	6 54·5	5·7	2·7	11·7	5·6	17·7	8·4
58	7 14·5	7 15·7	6 54·7	5·8	2·8	11·8	5·6	17·8	8·5
59	7 14·8	7 15·9	6 54·9	5·9	2·8	11·9	5·7	17·9	8·5
60	7 15·0	7 16·2	6 55·2	6·0	2·9	12·0	5·7	18·0	8·6

m 29	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	° ′	° ′	° ′	′	′	′	′	′	′
00	7 15·0	7 16·2	6 55·2	0·0	0·0	6·0	3·0	12·0	5·9
01	7 15·3	7 16·4	6 55·4	0·1	0·0	6·1	3·0	12·1	5·9
02	7 15·5	7 16·7	6 55·7	0·2	0·1	6·2	3·0	12·2	6·0
03	7 15·8	7 16·9	6 55·9	0·3	0·1	6·3	3·1	12·3	6·0
04	7 16·0	7 17·2	6 56·1	0·4	0·2	6·4	3·1	12·4	6·1
05	7 16·3	7 17·4	6 56·4	0·5	0·2	6·5	3·2	12·5	6·1
06	7 16·5	7 17·7	6 56·6	0·6	0·3	6·6	3·2	12·6	6·2
07	7 16·8	7 17·9	6 56·9	0·7	0·3	6·7	3·3	12·7	6·2
08	7 17·0	7 18·2	6 57·1	0·8	0·4	6·8	3·3	12·8	6·3
09	7 17·3	7 18·4	6 57·3	0·9	0·4	6·9	3·4	12·9	6·3
10	7 17·5	7 18·7	6 57·6	1·0	0·5	7·0	3·4	13·0	6·4
11	7 17·8	7 18·9	6 57·8	1·1	0·5	7·1	3·5	13·1	6·4
12	7 18·0	7 19·2	6 58·0	1·2	0·6	7·2	3·5	13·2	6·5
13	7 18·3	7 19·4	6 58·3	1·3	0·6	7·3	3·6	13·3	6·5
14	7 18·5	7 19·7	6 58·5	1·4	0·7	7·4	3·6	13·4	6·6
15	7 18·8	7 20·0	6 58·8	1·5	0·7	7·5	3·7	13·5	6·6
16	7 19·0	7 20·2	6. 59·0	1·6	0·8	7·6	3·7	13·6	6·7
17	7 19·3	7 20·5	6 59·2	1·7	0·8	7·7	3·8	13·7	6·7
18	7 19·5	7 20·7	6 59·5	1·8	0·9	7·8	3·8	13·8	6·8
19	7 19·8	7 21·0	6 59·7	1·9	0·9	7·9	3·9	13·9	6·8
20	7 20·0	7 21·2	7 00·0	2·0	1·0	8·0	3·9	14·0	6·9
21	7 20·3	7 21·5	7 00·2	2·1	1·0	8·1	4·0	14·1	6·9
22	7 20·5	7 21·7	7 00·4	2·2	1·1	8·2	4·0	14·2	7·0
23	7 20·8	7 22·0	7 00·7	2·3	1·1	8·3	4·1	14·3	7·0
24	7 21·0	7 22·2	7 00·9	2·4	1·2	8·4	4·1	14·4	7·1
25	7 21·3	7 22·5	7 01·1	2·5	1·2	8·5	4·2	14·5	7·1
26	7 21·5	7 22·7	7 01·4	2·6	1·3	8·6	4·2	14·6	7·2
27	7 21·8	7 23·0	7 01·6	2·7	1·3	8·7	4·3	14·7	7·2
28	7 22·0	7 23·2	7 01·9	2·8	1·4	8·8	4·3	14·8	7·3
29	7 22·3	7 23·5	7 02·1	2·9	1·4	8·9	4·4	14·9	7·3
30	7 22·5	7 23·7	7 02·3	3·0	1·5	9·0	4·4	15·0	7·4
31	7 22·8	7 24·0	7 02·6	3·1	1·5	9·1	4·5	15·1	7·4
32	7 23·0	7 24·2	7 02·8	3·2	1·6	9·2	4·5	15·2	7·5
33	7 23·3	7 24·5	7 03·1	3·3	1·6	9·3	4·6	15·3	7·5
34	7 23·5	7 24·7	7 03·3	3·4	1·7	9·4	4·6	15·4	7·6
35	7 23·8	7 25·0	7 03·5	3·5	1·7	9·5	4·7	15·5	7·6
36	7 24·0	7 25·2	7 03·8	3·6	1·8	9·6	4·7	15·6	7·7
37	7 24·3	7 25·5	7 04·0	3·7	1·8	9·7	4·8	15·7	7·7
38	7 24·5	7 25·7	7 04·3	3·8	1·9	9·8	4·8	15·8	7·8
39	7 24·8	7 26·0	7 04·5	3·9	1·9	9·9	4·9	15·9	7·8
40	7 25·0	7 26·2	7 04·7	4·0	2·0	10·0	4·9	16·0	7·9
41	7 25·3	7 26·5	7 05·0	4·1	2·0	10·1	5·0	16·1	7·9
42	7 25·5	7 26·7	7 05·2	4·2	2·1	10·2	5·0	16·2	8·0
43	7 25·8	7 27·0	7 05·4	4·3	2·1	10·3	5·1	16·3	8·0
44	7 26·0	7 27·2	7 05·7	4·4	2·2	10·4	5·1	16·4	8·1
45	7 26·3	7 27·5	7 05·9	4·5	2·2	10·5	5·2	16·5	8·1
46	7 26·5	7 27·7	7 06·2	4·6	2·3	10·6	5·2	16·6	8·2
47	7 26·8	7 28·0	7 06·4	4·7	2·3	10·7	5·3	16·7	8·2
48	7 27·0	7 28·2	7 06·6	4·8	2·4	10·8	5·3	16·8	8·3
49	7 27·3	7 28·5	7 06·9	4·9	2·4	10·9	5·4	16·9	8·3
50	7 27·5	7 28·7	7 07·1	5·0	2·5	11·0	5·4	17·0	8·4
51	7 27·8	7 29·0	7 07·4	5·1	2·5	11·1	5·5	17·1	8·4
52	7 28·0	7 29·2	7 07·6	5·2	2·6	11·2	5·5	17·2	8·5
53	7 28·3	7 29·5	7 07·8	5·3	2·6	11·3	5·6	17·3	8·5
54	7 28·5	7 29·7	7 08·1	5·4	2·7	11·4	5·6	17·4	8·6
55	7 28·8	7 30·0	7 08·3	5·5	2·7	11·5	5·7	17·5	8·6
56	7 29·0	7 30·2	7 08·5	5·6	2·8	11·6	5·7	17·6	8·7
57	7 29·3	7 30·5	7 08·8	5·7	2·8	11·7	5·8	17·7	8·7
58	7 29·5	7 30·7	7 09·0	5·8	2·9	11·8	5·8	17·8	8·8
59	7 29·8	7 31·0	7 09·3	5·9	2·9	11·9	5·9	17·9	8·8
60	7 30·0	7 31·2	7 09·5	6·0	3·0	12·0	5·9	18·0	8·9

m 30	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	7 30·0	7 31·2	7 09·5	0·0	0·0	6·0	3·1	12·0	6·1
01	7 30·3	7 31·5	7 09·7	0·1	0·1	6·1	3·1	12·1	6·2
02	7 30·5	7 31·7	7 10·0	0·2	0·1	6·2	3·2	12·2	6·2
03	7 30·8	7 32·0	7 10·2	0·3	0·2	6·3	3·2	12·3	6·3
04	7 31·0	7 32·2	7 10·5	0·4	0·2	6·4	3·3	12·4	6·3
05	7 31·3	7 32·5	7 10·7	0·5	0·3	6·5	3·3	12·5	6·4
06	7 31·5	7 32·7	7 10·9	0·6	0·3	6·6	3·4	12·6	6·4
07	7 31·8	7 33·0	7 11·2	0·7	0·4	6·7	3·4	12·7	6·5
08	7 32·0	7 33·2	7 11·4	0·8	0·4	6·8	3·5	12·8	6·5
09	7 32·3	7 33·5	7 11·6	0·9	0·5	6·9	3·5	12·9	6·6
10	7 32·5	7 33·7	7 11·9	1·0	0·5	7·0	3·6	13·0	6·6
11	7 32·8	7 34·0	7 12·1	1·1	0·6	7·1	3·6	13·1	6·7
12	7 33·0	7 34·2	7 12·4	1·2	0·6	7·2	3·7	13·2	6·7
13	7 33·3	7 34·5	7 12·6	1·3	0·7	7·3	3·7	13·3	6·8
14	7 33·5	7 34·7	7 12·8	1·4	0·7	7·4	3·8	13·4	6·8
15	7 33·8	7 35·0	7 13·1	1·5	0·8	7·5	3·8	13·5	6·9
16	7 34·0	7 35·2	7 13·3	1·6	0·8	7·6	3·9	13·6	6·9
17	7 34·3	7 35·5	7 13·6	1·7	0·9	7·7	3·9	13·7	7·0
18	7 34·5	7 35·7	7 13·8	1·8	0·9	7·8	4·0	13·8	7·0
19	7 34·8	7 36·0	7 14·0	1·9	1·0	7·9	4·0	13·9	7·1
20	7 35·0	7 36·2	7 14·3	2·0	1·0	8·0	4·1	14·0	7·1
21	7 35·3	7 36·5	7 14·5	2·1	1·1	8·1	4·1	14·1	7·2
22	7 35·5	7 36·7	7 14·7	2·2	1·1	8·2	4·2	14·2	7·2
23	7 35·8	7 37·0	7 15·0	2·3	1·2	8·3	4·2	14·3	7·3
24	7 36·0	7 37·2	7 15·2	2·4	1·2	8·4	4·3	14·4	7·3
25	7 36·3	7 37·5	7 15·5	2·5	1·3	8·5	4·3	14·5	7·4
26	7 36·5	7 37·7	7 15·7	2·6	1·3	8·6	4·4	14·6	7·4
27	7 36·8	7 38·0	7 15·9	2·7	1·4	8·7	4·4	14·7	7·5
28	7 37·0	7 38·3	7 16·2	2·8	1·4	8·8	4·5	14·8	7·5
29	7 37·3	7 38·5	7 16·4	2·9	1·5	8·9	4·5	14·9	7·6
30	7 37·5	7 38·8	7 16·7	3·0	1·5	9·0	4·6	15·0	7·6
31	7 37·8	7 39·0	7 16·9	3·1	1·6	9·1	4·6	15·1	7·7
32	7 38·0	7 39·3	7 17·1	3·2	1·6	9·2	4·7	15·2	7·7
33	7 38·3	7 39·5	7 17·4	3·3	1·7	9·3	4·7	15·3	7·8
34	7 38·5	7 39·8	7 17·6	3·4	1·7	9·4	4·8	15·4	7·8
35	7 38·8	7 40·0	7 17·9	3·5	1·8	9·5	4·8	15·5	7·9
36	7 39·0	7 40·3	7 18·1	3·6	1·8	9·6	4·9	15·6	7·9
37	7 39·3	7 40·5	7 18·3	3·7	1·9	9·7	4·9	15·7	8·0
38	7 39·5	7 40·8	7 18·6	3·8	1·9	9·8	5·0	15·8	8·0
39	7 39·8	7 41·0	7 18·8	3·9	2·0	9·9	5·0	15·9	8·1
40	7 40·0	7 41·3	7 19·0	4·0	2·0	10·0	5·1	16·0	8·1
41	7 40·3	7 41·5	7 19·3	4·1	2·1	10·1	5·1	16·1	8·2
42	7 40·5	7 41·8	7 19·5	4·2	2·1	10·2	5·2	16·2	8·2
43	7 40·8	7 42·0	7 19·8	4·3	2·2	10·3	5·2	16·3	8·3
44	7 41·0	7 42·3	7 20·0	4·4	2·2	10·4	5·3	16·4	8·3
45	7 41·3	7 42·5	7 20·2	4·5	2·3	10·5	5·3	16·5	8·4
46	7 41·5	7 42·8	7 20·5	4·6	2·3	10·6	5·4	16·6	8·4
47	7 41·8	7 43·0	7 20·7	4·7	2·4	10·7	5·4	16·7	8·5
48	7 42·0	7 43·3	7 21·0	4·8	2·4	10·8	5·5	16·8	8·5
49	7 42·3	7 43·5	7 21·2	4·9	2·5	10·9	5·5	16·9	8·6
50	7 42·5	7 43·8	7 21·4	5·0	2·5	11·0	5·6	17·0	8·6
51	7 42·8	7 44·0	7 21·7	5·1	2·6	11·1	5·6	17·1	8·7
52	7 43·0	7 44·3	7 21·9	5·2	2·6	11·2	5·7	17·2	8·7
53	7 43·3	7 44·5	7 22·1	5·3	2·7	11·3	5·7	17·3	8·8
54	7 43·5	7 44·8	7 22·4	5·4	2·7	11·4	5·8	17·4	8·8
55	7 43·8	7 45·0	7 22·6	5·5	2·8	11·5	5·8	17·5	8·9
56	7 44·0	7 45·3	7 22·9	5·6	2·8	11·6	5·9	17·6	8·9
57	7 44·3	7 45·5	7 23·1	5·7	2·9	11·7	5·9	17·7	9·0
58	7 44·5	7 45·8	7 23·3	5·8	2·9	11·8	6·0	17·8	9·0
59	7 44·8	7 46·0	7 23·6	5·9	3·0	11·9	6·0	17·9	9·1
60	7 45·0	7 46·3	7 23·8	6·0	3·1	12·0	6·1	18·0	9·2

m 31	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	7 45·0	7 46·3	7 23·8	0·0	0·0	6·0	3·2	12·0	6·3
01	7 45·3	7 46·5	7 24·1	0·1	0·1	6·1	3·2	12·1	6·4
02	7 45·5	7 46·8	7 24·3	0·2	0·1	6·2	3·3	12·2	6·4
03	7 45·8	7 47·0	7 24·5	0·3	0·2	6·3	3·3	12·3	6·5
04	7 46·0	7 47·3	7 24·8	0·4	0·2	6·4	3·4	12·4	6·5
05	7 46·3	7 47·5	7 25·0	0·5	0·3	6·5	3·4	12·5	6·6
06	7 46·5	7 47·8	7 25·2	0·6	0·3	6·6	3·5	12·6	6·6
07	7 46·8	7 48·0	7 25·5	0·7	0·4	6·7	3·5	12·7	6·7
08	7 47·0	7 48·3	7 25·7	0·8	0·4	6·8	3·6	12·8	6·7
09	7 47·3	7 48·5	7 26·0	0·9	0·5	6·9	3·6	12·9	6·8
10	7 47·5	7 48·8	7 26·2	1·0	0·5	7·0	3·7	13·0	6·8
11	7 47·8	7 49·0	7 26·4	1·1	0·6	7·1	3·7	13·1	6·9
12	7 48·0	7 49·3	7 26·7	1·2	0·6	7·2	3·8	13·2	6·9
13	7 48·3	7 49·5	7 26·9	1·3	0·7	7·3	3·8	13·3	7·0
14	7 48·5	7 49·8	7 27·2	1·4	0·7	7·4	3·9	13·4	7·0
15	7 48·8	7 50·0	7 27·4	1·5	0·8	7·5	3·9	13·5	7·1
16	7 49·0	7 50·3	7 27·6	1·6	0·8	7·6	4·0	13·6	7·1
17	7 49·3	7 50·5	7 27·9	1·7	0·9	7·7	4·0	13·7	7·2
18	7 49·5	7 50·8	7 28·1	1·8	0·9	7·8	4·1	13·8	7·2
19	7 49·8	7 51·0	7 28·4	1·9	1·0	7·9	4·1	13·9	7·3
20	7 50·0	7 51·3	7 28·6	2·0	1·1	8·0	4·2	14·0	7·4
21	7 50·3	7 51·5	7 28·8	2·1	1·1	8·1	4·3	14·1	7·4
22	7 50·5	7 51·8	7 29·1	2·2	1·2	8·2	4·3	14·2	7·5
23	7 50·8	7 52·0	7 29·3	2·3	1·2	8·3	4·4	14·3	7·5
24	7 51·0	7 52·3	7 29·5	2·4	1·3	8·4	4·4	14·4	7·6
25	7 51·3	7 52·5	7 29·8	2·5	1·3	8·5	4·5	14·5	7·6
26	7 51·5	7 52·8	7 30·0	2·6	1·4	8·6	4·5	14·6	7·7
27	7 51·8	7 53·0	7 30·3	2·7	1·4	8·7	4·6	14·7	7·7
28	7 52·0	7 53·3	7 30·5	2·8	1·5	8·8	4·6	14·8	7·8
29	7 52·3	7 53·5	7 30·7	2·9	1·5	8·9	4·7	14·9	7·8
30	7 52·5	7 53·8	7 31·0	3·0	1·6	9·0	4·7	15·0	7·9
31	7 52·8	7 54·0	7 31·2	3·1	1·6	9·1	4·8	15·1	7·9
32	7 53·0	7 54·3	7 31·5	3·2	1·7	9·2	4·8	15·2	8·0
33	7 53·3	7 54·5	7 31·7	3·3	1·7	9·3	4·9	15·3	8·0
34	7 53·5	7 54·8	7 31·9	3·4	1·8	9·4	4·9	15·4	8·1
35	7 53·8	7 55·0	7 32·2	3·5	1·8	9·5	5·0	15·5	8·1
36	7 54·0	7 55·3	7 32·4	3·6	1·9	9·6	5·0	15·6	8·2
37	7 54·3	7 55·5	7 32·6	3·7	1·9	9·7	5·1	15·7	8·2
38	7 54·5	7 55·8	7 32·9	3·8	2·0	9·8	5·1	15·8	8·3
39	7 54·8	7 56·0	7 33·1	3·9	2·0	9·9	5·2	15·9	8·3
40	7 55·0	7 56·3	7 33·4	4·0	2·1	10·0	5·3	16·0	8·4
41	7 55·3	7 56·6	7 33·6	4·1	2·2	10·1	5·3	16·1	8·5
42	7 55·5	7 56·8	7 33·8	4·2	2·2	10·2	5·4	16·2	8·5
43	7 55·8	7 57·1	7 34·1	4·3	2·3	10·3	5·4	16·3	8·6
44	7 56·0	7 57·3	7 34·3	4·4	2·3	10·4	5·5	16·4	8·6
45	7 56·3	7 57·6	7 34·6	4·5	2·4	10·5	5·5	16·5	8·7
46	7 56·5	7 57·8	7 34·8	4·6	2·4	10·6	5·6	16·6	8·7
47	7 56·8	7 58·1	7 35·0	4·7	2·5	10·7	5·6	16·7	8·8
48	7 57·0	7 58·3	7 35·3	4·8	2·5	10·8	5·7	16·8	8·8
49	7 57·3	7 58·6	7 35·5	4·9	2·6	10·9	5·7	16·9	8·9
50	7 57·5	7 58·8	7 35·7	5·0	2·6	11·0	5·8	17·0	8·9
51	7 57·8	7 59·1	7 36·0	5·1	2·7	11·1	5·8	17·1	9·0
52	7 58·0	7 59·3	7 36·2	5·2	2·7	11·2	5·9	17·2	9·0
53	7 58·3	7 59·6	7 36·5	5·3	2·8	11·3	5·9	17·3	9·1
54	7 58·5	7 59·8	7 36·7	5·4	2·8	11·4	6·0	17·4	9·1
55	7 58·8	8 00·1	7 36·9	5·5	2·9	11·5	6·0	17·5	9·2
56	7 59·0	8 00·3	7 37·2	5·6	2·9	11·6	6·1	17·6	9·2
57	7 59·3	8 00·6	7 37·4	5·7	3·0	11·7	6·1	17·7	9·3
58	7 59·5	8 00·8	7 37·7	5·8	3·0	11·8	6·2	17·8	9·3
59	7 59·8	8 01·1	7 37·9	5·9	3·1	11·9	6·2	17·9	9·4
60	8 00·0	8 01·3	7 38·1	6·0	3·2	12·0	6·3	18·0	9·5

m 32	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	8 00·0	8 01·3	7 38·1	0·0	0·0	6·0	3·3	12·0	6·5
01	8 00·3	8 01·6	7 38·4	0·1	0·1	6·1	3·3	12·1	6·6
02	8 00·5	8 01·8	7 38·6	0·2	0·1	6·2	3·4	12·2	6·6
03	8 00·8	8 02·1	7 38·8	0·3	0·2	6·3	3·4	12·3	6·7
04	8 01·0	8 02·3	7 39·1	0·4	0·2	6·4	3·5	12·4	6·7
05	8 01·3	8 02·6	7 39·3	0·5	0·3	6·5	3·5	12·5	6·8
06	8 01·5	8 02·8	7 39·6	0·6	0·3	6·6	3·6	12·6	6·8
07	8 01·8	8 03·1	7 39·8	0·7	0·4	6·7	3·6	12·7	6·9
08	8 02·0	8 03·3	7 40·0	0·8	0·4	6·8	3·7	12·8	6·9
09	8 02·3	8 03·6	7 40·3	0·9	0·5	6·9	3·7	12·9	7·0
10	8 02·5	8 03·8	7 40·5	1·0	0·5	7·0	3·8	13·0	7·0
11	8 02·8	8 04·1	7 40·8	1·1	0·6	7·1	3·8	13·1	7·1
12	8 03·0	8 04·3	7 41·0	1·2	0·7	7·2	3·9	13·2	7·2
13	8 03·3	8 04·6	7 41·2	1·3	0·7	7·3	4·0	13·3	7·2
14	8 03·5	8 04·8	7 41·5	1·4	0·8	7·4	4·0	13·4	7·3
15	8 03·8	8 05·1	7 41·7	1·5	0·8	7·5	4·1	13·5	7·3
16	8 04·0	8 05·3	7 42·0	1·6	0·9	7·6	4·1	13·6	7·4
17	8 04·3	8 05·6	7 42·2	1·7	0·9	7·7	4·2	13·7	7·4
18	8 04·5	8 05·8	7 42·4	1·8	1·0	7·8	4·2	13·8	7·5
19	8 04·8	8 06·1	7 42·7	1·9	1·0	7·9	4·3	13·9	7·5
20	8 05·0	8 06·3	7 42·9	2·0	1·1	8·0	4·3	14·0	7·6
21	8 05·3	8 06·6	7 43·1	2·1	1·1	8·1	4·4	14·1	7·6
22	8 05·5	8 06·8	7 43·4	2·2	1·2	8·2	4·4	14·2	7·7
23	8 05·8	8 07·1	7 43·6	2·3	1·2	8·3	4·5	14·3	7·7
24	8 06·0	8 07·3	7 43·9	2·4	1·3	8·4	4·6	14·4	7·8
25	8 06·3	8 07·6	7 44·1	2·5	1·4	8·5	4·6	14·5	7·9
26	8 06·5	8 07·8	7 44·3	2·6	1·4	8·6	4·7	14·6	7·9
27	8 06·8	8 08·1	7 44·6	2·7	1·5	8·7	4·7	14·7	8·0
28	8 07·0	8 08·3	7 44·8	2·8	1·5	8·8	4·8	14·8	8·0
29	8 07·3	8 08·6	7 45·1	2·9	1·6	8·9	4·8	14·9	8·1
30	8 07·5	8 08·8	7 45·3	3·0	1·6	9·0	4·9	15·0	8·1
31	8 07·8	8 09·1	7 45·5	3·1	1·7	9·1	4·9	15·1	8·2
32	8 08·0	8 09·3	7 45·8	3·2	1·7	9·2	5·0	15·2	8·2
33	8 08·3	8 09·6	7 46·0	3·3	1·8	9·3	5·0	15·3	8·3
34	8 08·5	8 09·8	7 46·2	3·4	1·8	9·4	5·1	15·4	8·3
35	8 08·8	8 10·1	7 46·5	3·5	1·9	9·5	5·1	15·5	8·4
36	8 09·0	8 10·3	7 46·7	3·6	2·0	9·6	5·2	15·6	8·5
37	8 09·3	8 10·6	7 47·0	3·7	2·0	9·7	5·3	15·7	8·5
38	8 09·5	8 10·8	7 47·2	3·8	2·1	9·8	5·3	15·8	8·6
39	8 09·8	8 11·1	7 47·4	3·9	2·1	9·9	5·4	15·9	8·6
40	8 10·0	8 11·3	7 47·7	4·0	2·2	10·0	5·4	16·0	8·7
41	8 10·3	8 11·6	7 47·9	4·1	2·2	10·1	5·5	16·1	8·7
42	8 10·5	8 11·8	7 48·2	4·2	2·3	10·2	5·5	16·2	8·8
43	8 10·8	8 12·1	7 48·4	4·3	2·3	10·3	5·6	16·3	8·8
44	8 11·0	8 12·3	7 48·6	4·4	2·4	10·4	5·6	16·4	8·9
45	8 11·3	8 12·6	7 48·9	4·5	2·4	10·5	5·7	16·5	8·9
46	8 11·5	8 12·8	7 49·1	4·6	2·5	10·6	5·7	16·6	9·0
47	8 11·8	8 13·1	7 49·3	4·7	2·5	10·7	5·8	16·7	9·0
48	8 12·0	8 13·3	7 49·6	4·8	2·6	10·8	5·9	16·8	9·1
49	8 12·3	8 13·6	7 49·8	4·9	2·7	10·9	5·9	16·9	9·2
50	8 12·5	8 13·8	7 50·1	5·0	2·7	11·0	6·0	17·0	9·2
51	8 12·8	8 14·1	7 50·3	5·1	2·8	11·1	6·0	17·1	9·3
52	8 13·0	8 14·3	7 50·5	5·2	2·8	11·2	6·1	17·2	9·3
53	8 13·3	8 14·6	7 50·8	5·3	2·9	11·3	6·1	17·3	9·4
54	8 13·5	8 14·9	7 51·0	5·4	2·9	11·4	6·2	17·4	9·4
55	8 13·8	8 15·1	7 51·3	5·5	3·0	11·5	6·2	17·5	9·5
56	8 14·0	8 15·4	7 51·5	5·6	3·0	11·6	6·3	17·6	9·5
57	8 14·3	8 15·6	7 51·7	5·7	3·1	11·7	6·3	17·7	9·6
58	8 14·5	8 15·9	7 52·0	5·8	3·1	11·8	6·4	17·8	9·6
59	8 14·8	8 16·1	7 52·2	5·9	3·2	11·9	6·4	17·9	9·7
60	8 15·0	8 16·4	7 52·5	6·0	3·3	12·0	6·5	18·0	9·8

m 33	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	8 15·0	8 16·4	7 52·5	0·0	0·0	6·0	3·4	12·0	6·7
01	8 15·3	8 16·6	7 52·7	0·1	0·1	6·1	3·4	12·1	6·8
02	8 15·5	8 16·9	7 52·9	0·2	0·1	6·2	3·5	12·2	6·8
03	8 15·8	8 17·1	7 53·2	0·3	0·2	6·3	3·5	12·3	6·9
04	8 16·0	8 17·4	7 53·4	0·4	0·2	6·4	3·6	12·4	6·9
05	8 16·3	8 17·6	7 53·6	0·5	0·3	6·5	3·6	12·5	7·0
06	8 16·5	8 17·9	7 53·9	0·6	0·3	6·6	3·7	12·6	7·0
07	8 16·8	8 18·1	7 54·1	0·7	0·4	6·7	3·7	12·7	7·1
08	8 17·0	8 18·4	7 54·4	0·8	0·4	6·8	3·8	12·8	7·1
09	8 17·3	8 18·6	7 54·6	0·9	0·5	6·9	3·9	12·9	7·2
10	8 17·5	8 18·9	7 54·8	1·0	0·6	7·0	3·9	13·0	7·3
11	8 17·8	8 19·1	7 55·1	1·1	0·6	7·1	4·0	13·1	7·3
12	8 18·0	8 19·4	7 55·3	1·2	0·7	7·2	4·0	13·2	7·4
13	8 18·3	8 19·6	7 55·6	1·3	0·7	7·3	4·1	13·3	7·4
14	8 18·5	8 19·9	7 55·8	1·4	0·8	7·4	4·1	13·4	7·5
15	8 18·8	8 20·1	7 56·0	1·5	0·8	7·5	4·2	13·5	7·5
16	8 19·0	8 20·4	7 56·3	1·6	0·9	7·6	4·2	13·6	7·6
17	8 19·3	8 20·6	7 56·5	1·7	0·9	7·7	4·3	13·7	7·6
18	8 19·5	8 20·9	7 56·7	1·8	1·0	7·8	4·4	13·8	7·7
19	8 19·8	8 21·1	7 57·0	1·9	1·1	7·9	4·4	13·9	7·8
20	8 20·0	8 21·4	7 57·2	2·0	1·1	8·0	4·5	14·0	7·8
21	8 20·3	8 21·6	7 57·5	2·1	1·2	8·1	4·5	14·1	7·9
22	8 20·5	8 21·9	7 57·7	2·2	1·2	8·2	4·6	14·2	7·9
23	8 20·8	8 22·1	7 57·9	2·3	1·3	8·3	4·6	14·3	8·0
24	8 21·0	8 22·4	7 58·2	2·4	1·3	8·4	4·7	14·4	8·0
25	8 21·3	8 22·6	7 58·4	2·5	1·4	8·5	4·7	14·5	8·1
26	8 21·5	8 22·9	7 58·7	2·6	1·5	8·6	4·8	14·6	8·2
27	8 21·8	8 23·1	7 58·9	2·7	1·5	8·7	4·9	14·7	8·2
28	8 22·0	8 23·4	7 59·1	2·8	1·6	8·8	4·9	14·8	8·3
29	8 22·3	8 23·6	7 59·4	2·9	1·6	8·9	5·0	14·9	8·3
30	8 22·5	8 23·9	7 59·6	3·0	1·7	9·0	5·0	15·0	8·4
31	8 22·8	8 24·1	7 59·8	3·1	1·7	9·1	5·1	15·1	8·4
32	8 23·0	8 24·4	8 00·1	3·2	1·8	9·2	5·1	15·2	8·5
33	8 23·3	8 24·6	8 00·3	3·3	1·8	9·3	5·2	15·3	8·5
34	8 23·5	8 24·9	8 00·6	3·4	1·9	9·4	5·2	15·4	8·6
35	8 23·8	8 25·1	8 00·8	3·5	2·0	9·5	5·3	15·5	8·7
36	8 24·0	8 25·4	8 01·0	3·6	2·0	9·6	5·4	15·6	8·7
37	8 24·3	8 25·6	8 01·3	3·7	2·1	9·7	5·4	15·7	8·8
38	8 24·5	8 25·9	8 01·5	3·8	2·1	9·8	5·5	15·8	8·8
39	8 24·8	8 26·1	8 01·8	3·9	2·2	9·9	5·5	15·9	8·9
40	8 25·0	8 26·4	8 02·0	4·0	2·2	10·0	5·6	16·0	8·9
41	8 25·3	8 26·6	8 02·2	4·1	2·3	10·1	5·6	16·1	9·0
42	8 25·5	8 26·9	8 02·5	4·2	2·3	10·2	5·7	16·2	9·0
43	8 25·8	8 27·1	8 02·7	4·3	2·4	10·3	5·8	16·3	9·1
44	8 26·0	8 27·4	8 02·9	4·4	2·5	10·4	5·8	16·4	9·2
45	8 26·3	8 27·6	8 03·2	4·5	2·5	10·5	5·9	16·5	9·2
46	8 26·5	8 27·9	8 03·4	4·6	2·6	10·6	5·9	16·6	9·3
47	8 26·8	8 28·1	8 03·7	4·7	2·6	10·7	6·0	16·7	9·3
48	8 27·0	8 28·4	8 03·9	4·8	2·7	10·8	6·0	16·8	9·4
49	8 27·3	8 28·6	8 04·1	4·9	2·7	10·9	6·1	16·9	9·4
50	8 27·5	8 28·9	8 04·4	5·0	2·8	11·0	6·1	17·0	9·5
51	8 27·8	8 29·1	8 04·6	5·1	2·8	11·1	6·2	17·1	9·5
52	8 28·0	8 29·4	8 04·9	5·2	2·9	11·2	6·3	17·2	9·6
53	8 28·3	8 29·6	8 05·1	5·3	3·0	11·3	6·3	17·3	9·7
54	8 28·5	8 29·9	8 05·3	5·4	3·0	11·4	6·4	17·4	9·7
55	8 28·8	8 30·1	8 05·6	5·5	3·1	11·5	6·4	17·5	9·8
56	8 29·0	8 30·4	8 05·8	5·6	3·1	11·6	6·5	17·6	9·8
57	8 29·3	8 30·6	8 06·1	5·7	3·2	11·7	6·5	17·7	9·9
58	8 29·5	8 30·9	8 06·3	5·8	3·2	11·8	6·6	17·8	9·9
59	8 29·8	8 31·1	8 06·5	5·9	3·3	11·9	6·6	17·9	10·0
60	8 30·0	8 31·4	8 06·8	6·0	3·4	12·0	6·7	18·0	10·1

34m	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	8 30·0	8 31·4	8 06·8	0·0	0·0	6·0	3·5	12·0	6·9
01	8 30·3	8 31·6	8 07·0	0·1	0·1	6·1	3·5	12·1	7·0
02	8 30·5	8 31·9	8 07·2	0·2	0·1	6·2	3·6	12·2	7·0
03	8 30·8	8 32·1	8 07·5	0·3	0·2	6·3	3·6	12·3	7·1
04	8 31·0	8 32·4	8 07·7	0·4	0·2	6·4	3·7	12·4	7·1
05	8 31·3	8 32·6	8 08·0	0·5	0·3	6·5	3·7	12·5	7·2
06	8 31·5	8 32·9	8 08·2	0·6	0·3	6·6	3·8	12·6	7·2
07	8 31·8	8 33·2	8 08·4	0·7	0·4	6·7	3·9	12·7	7·3
08	8 32·0	8 33·4	8 08·7	0·8	0·5	6·8	3·9	12·8	7·4
09	8 32·3	8 33·7	8 08·9	0·9	0·5	6·9	4·0	12·9	7·4
10	8 32·5	8 33·9	8 09·2	1·0	0·6	7·0	4·0	13·0	7·5
11	8 32·8	8 34·2	8 09·4	1·1	0·6	7·1	4·1	13·1	7·5
12	8 33·0	8 34·4	8 09·6	1·2	0·7	7·2	4·1	13·2	7·6
13	8 33·3	8 34·7	8 09·9	1·3	0·7	7·3	4·2	13·3	7·6
14	8 33·5	8 34·9	8 10·1	1·4	0·8	7·4	4·3	13·4	7·7
15	8 33·8	8 35·2	8 10·3	1·5	0·9	7·5	4·3	13·5	7·8
16	8 34·0	8 35·4	8 10·6	1·6	0·9	7·6	4·4	13·6	7·8
17	8 34·3	8 35·7	8 10·8	1·7	1·0	7·7	4·4	13·7	7·9
18	8 34·5	8 35·9	8 11·1	1·8	1·0	7·8	4·5	13·8	7·9
19	8 34·8	8 36·2	8 11·3	1·9	1·1	7·9	4·5	13·9	8·0
20	8 35·0	8 36·4	8 11·5	2·0	1·2	8·0	4·6	14·0	8·1
21	8 35·3	8 36·7	8 11·8	2·1	1·2	8·1	4·7	14·1	8·1
22	8 35·5	8 36·9	8 12·0	2·2	1·3	8·2	4·7	14·2	8·2
23	8 35·8	8 37·2	8 12·3	2·3	1·3	8·3	4·8	14·3	8·2
24	8 36·0	8 37·4	8 12·5	2·4	1·4	8·4	4·8	14·4	8·3
25	8 36·3	8 37·7	8 12·7	2·5	1·4	8·5	4·9	14·5	8·3
26	8 36·5	8 37·9	8 13·0	2·6	1·5	8·6	4·9	14·6	8·4
27	8 36·8	8 38·2	8 13·2	2·7	1·6	8·7	5·0	14·7	8·5
28	8 37·0	8 38·4	8 13·4	2·8	1·6	8·8	5·1	14·8	8·5
29	8 37·3	8 38·7	8 13·7	2·9	1·7	8·9	5·1	14·9	8·6
30	8 37·5	8 38·9	8 13·9	3·0	1·7	9·0	5·2	15·0	8·6
31	8 37·8	8 39·2	8 14·2	3·1	1·8	9·1	5·2	15·1	8·7
32	8 38·0	8 39·4	8 14·4	3·2	1·8	9·2	5·3	15·2	8·7
33	8 38·3	8 39·7	8 14·6	3·3	1·9	9·3	5·3	15·3	8·8
34	8 38·5	8 39·9	8 14·9	3·4	2·0	9·4	5·4	15·4	8·9
35	8 38·8	8 40·2	8 15·1	3·5	2·0	9·5	5·5	15·5	8·9
36	8 39·0	8 40·4	8 15·4	3·6	2·1	9·6	5·5	15·6	9·0
37	8 39·3	8 40·7	8 15·6	3·7	2·1	9·7	5·6	15·7	9·0
38	8 39·5	8 40·9	8 15·8	3·8	2·2	9·8	5·6	15·8	9·1
39	8 39·8	8 41·2	8 16·1	3·9	2·2	9·9	5·7	15·9	9·1
40	8 40·0	8 41·4	8 16·3	4·0	2·3	10·0	5·8	16·0	9·2
41	8 40·3	8 41·7	8 16·5	4·1	2·4	10·1	5·8	16·1	9·3
42	8 40·5	8 41·9	8 16·8	4·2	2·4	10·2	5·9	16·2	9·3
43	8 40·8	8 42·2	8 17·0	4·3	2·5	10·3	5·9	16·3	9·4
44	8 41·0	8 42·4	8 17·3	4·4	2·5	10·4	6·0	16·4	9·4
45	8 41·3	8 42·7	8 17·5	4·5	2·6	10·5	6·0	16·5	9·5
46	8 41·5	8 42·9	8 17·7	4·6	2·6	10·6	6·1	16·6	9·5
47	8 41·8	8 43·2	8 18·0	4·7	2·7	10·7	6·2	16·7	9·6
48	8 42·0	8 43·4	8 18·2	4·8	2·8	10·8	6·2	16·8	9·7
49	8 42·3	8 43·7	8 18·5	4·9	2·8	10·9	6·3	16·9	9·7
50	8 42·5	8 43·9	8 18·7	5·0	2·9	11·0	6·3	17·0	9·8
51	8 42·8	8 44·2	8 18·9	5·1	2·9	11·1	6·4	17·1	9·8
52	8 43·0	8 44·4	8 19·2	5·2	3·0	11·2	6·4	17·2	9·9
53	8 43·3	8 44·7	8 19·4	5·3	3·0	11·3	6·5	17·3	9·9
54	8 43·5	8 44·9	8 19·7	5·4	3·1	11·4	6·6	17·4	10·0
55	8 43·8	8 45·2	8 19·9	5·5	3·2	11·5	6·6	17·5	10·1
56	8 44·0	8 45·4	8 20·1	5·6	3·2	11·6	6·7	17·6	10·1
57	8 44·3	8 45·7	8 20·4	5·7	3·3	11·7	6·7	17·7	10·2
58	8 44·5	8 45·9	8 20·6	5·8	3·3	11·8	6·8	17·8	10·2
59	8 44·8	8 46·2	8 20·8	5·9	3·4	11·9	6·8	17·9	10·3
60	8 45·0	8 46·4	8 21·1	6·0	3·5	12·0	6·9	18·0	10·4

35m	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	8 45·0	8 46·4	8 21·1	0·0	0·0	6·0	3·6	12·0	7·1
01	8 45·3	8 46·7	8 21·3	0·1	0·1	6·1	3·6	12·1	7·2
02	8 45·5	8 46·9	8 21·6	0·2	0·1	6·2	3·7	12·2	7·2
03	8 45·8	8 47·2	8 21·8	0·3	0·2	6·3	3·7	12·3	7·3
04	8 46·0	8 47·4	8 22·0	0·4	0·2	6·4	3·8	12·4	7·3
05	8 46·3	8 47·7	8 22·3	0·5	0·3	6·5	3·8	12·5	7·4
06	8 46·5	8 47·9	8 22·5	0·6	0·4	6·6	3·9	12·6	7·5
07	8 46·8	8 48·2	8 22·8	0·7	0·4	6·7	4·0	12·7	7·5
08	8 47·0	8 48·4	8 23·0	0·8	0·5	6·8	4·0	12·8	7·6
09	8 47·3	8 48·7	8 23·2	0·9	0·5	6·9	4·1	12·9	7·6
10	8 47·5	8 48·9	8 23·5	1·0	0·6	7·0	4·1	13·0	7·7
11	8 47·8	8 49·2	8 23·7	1·1	0·7	7·1	4·2	13·1	7·8
12	8 48·0	8 49·4	8 23·9	1·2	0·7	7·2	4·3	13·2	7·8
13	8 48·3	8 49·7	8 24·2	1·3	0·8	7·3	4·3	13·3	7·9
14	8 48·5	8 49·9	8 24·4	1·4	0·8	7·4	4·4	13·4	7·9
15	8 48·8	8 50·2	8 24·7	1·5	0·9	7·5	4·4	13·5	8·0
16	8 49·0	8 50·4	8 24·9	1·6	0·9	7·6	4·5	13·6	8·0
17	8 49·3	8 50·7	8 25·1	1·7	1·0	7·7	4·6	13·7	8·1
18	8 49·5	8 50·9	8 25·4	1·8	1·1	7·8	4·6	13·8	8·2
19	8 49·8	8 51·2	8 25·6	1·9	1·1	7·9	4·7	13·9	8·2
20	8 50·0	8 51·5	8 25·9	2·0	1·2	8·0	4·7	14·0	8·3
21	8 50·3	8 51·7	8 26·1	2·1	1·2	8·1	4·8	14·1	8·3
22	8 50·5	8 52·0	8 26·3	2·2	1·3	8·2	4·9	14·2	8·4
23	8 50·8	8 52·2	8 26·6	2·3	1·4	8·3	4·9	14·3	8·5
24	8 51·0	8 52·5	8 26·8	2·4	1·4	8·4	5·0	14·4	8·5
25	8 51·3	8 52·7	8 27·0	2·5	1·5	8·5	5·0	14·5	8·6
26	8 51·5	8 53·0	8 27·3	2·6	1·5	8·6	5·1	14·6	8·6
27	8 51·8	8 53·2	8 27·5	2·7	1·6	8·7	5·1	14·7	8·7
28	8 52·0	8 53·5	8 27·8	2·8	1·7	8·8	5·2	14·8	8·8
29	8 52·3	8 53·7	8 28·0	2·9	1·7	8·9	5·3	14·9	8·8
30	8 52·5	8 54·0	8 28·2	3·0	1·8	9·0	5·3	15·0	8·9
31	8 52·8	8 54·2	8 28·5	3·1	1·8	9·1	5·4	15·1	8·9
32	8 53·0	8 54·5	8 28·7	3·2	1·9	9·2	5·4	15·2	9·0
33	8 53·3	8 54·7	8 29·0	3·3	2·0	9·3	5·5	15·3	9·1
34	8 53·5	8 55·0	8 29·2	3·4	2·0	9·4	5·6	15·4	9·1
35	8 53·8	8 55·2	8 29·4	3·5	2·1	9·5	5·6	15·5	9·2
36	8 54·0	8 55·5	8 29·7	3·6	2·1	9·6	5·7	15·6	9·2
37	8 54·3	8 55·7	8 29·9	3·7	2·2	9·7	5·7	15·7	9·3
38	8 54·5	8 56·0	8 30·2	3·8	2·2	9·8	5·8	15·8	9·3
39	8 54·8	8 56·2	8 30·4	3·9	2·3	9·9	5·9	15·9	9·4
40	8 55·0	8 56·5	8 30·6	4·0	2·4	10·0	5·9	16·0	9·5
41	8 55·3	8 56·7	8 30·9	4·1	2·4	10·1	6·0	16·1	9·5
42	8 55·5	8 57·0	8 31·1	4·2	2·5	10·2	6·0	16·2	9·6
43	8 55·8	8 57·2	8 31·3	4·3	2·5	10·3	6·1	16·3	9·6
44	8 56·0	8 57·5	8 31·6	4·4	2·6	10·4	6·2	16·4	9·7
45	8 56·3	8 57·7	8 31·8	4·5	2·7	10·5	6·2	16·5	9·8
46	8 56·5	8 58·0	8 32·1	4·6	2·7	10·6	6·3	16·6	9·8
47	8 56·8	8 58·2	8 32·3	4·7	2·8	10·7	6·3	16·7	9·9
48	8 57·0	8 58·5	8 32·5	4·8	2·8	10·8	6·4	16·8	9·9
49	8 57·3	8 58·7	8 32·8	4·9	2·9	10·9	6·4	16·9	10·0
50	8 57·5	8 59·0	8 33·0	5·0	3·0	11·0	6·5	17·0	10·1
51	8 57·8	8 59·2	8 33·3	5·1	3·0	11·1	6·6	17·1	10·1
52	8 58·0	8 59·5	8 33·5	5·2	3·1	11·2	6·6	17·2	10·2
53	8 58·3	8 59·7	8 33·7	5·3	3·1	11·3	6·7	17·3	10·2
54	8 58·5	9 00·0	8 34·0	5·4	3·2	11·4	6·7	17·4	10·3
55	8 58·8	9 00·2	8 34·2	5·5	3·3	11·5	6·8	17·5	10·4
56	8 59·0	9 00·5	8 34·4	5·6	3·3	11·6	6·9	17·6	10·4
57	8 59·3	9 00·7	8 34·7	5·7	3·4	11·7	6·9	17·7	10·5
58	8 59·5	9 01·0	8 34·9	5·8	3·4	11·8	7·0	17·8	10·5
59	8 59·8	9 01·2	8 35·2	5·9	3·5	11·9	7·0	17·9	10·6
60	9 00·0	9 01·5	8 35·4	6·0	3·6	12·0	7·1	18·0	10·7

m 36	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	9 00·0	9 01·5	8 35·4	0·0	0·0	6·0	3·7	12·0	7·3
01	9 00·3	9 01·7	8 35·6	0·1	0·1	6·1	3·7	12·1	7·4
02	9 00·5	9 02·0	8 35·9	0·2	0·1	6·2	3·8	12·2	7·4
03	9 00·8	9 02·2	8 36·1	0·3	0·2	6·3	3·8	12·3	7·5
04	9 01·0	9 02·5	8 36·4	0·4	0·2	6·4	3·9	12·4	7·5
05	9 01·3	9 02·7	8 36·6	0·5	0·3	6·5	4·0	12·5	7·6
06	9 01·5	9 03·0	8 36·8	0·6	0·4	6·6	4·0	12·6	7·7
07	9 01·8	9 03·2	8 37·1	0·7	0·4	6·7	4·1	12·7	7·7
08	9 02·0	9 03·5	8 37·3	0·8	0·5	6·8	4·1	12·8	7·8
09	9 02·3	9 03·7	8 37·5	0·9	0·5	6·9	4·2	12·9	7·8
10	9 02·5	9 04·0	8 37·8	1·0	0·6	7·0	4·3	13·0	7·9
11	9 02·8	9 04·2	8 38·0	1·1	0·7	7·1	4·3	13·1	8·0
12	9 03·0	9 04·5	8 38·3	1·2	0·7	7·2	4·4	13·2	8·0
13	9 03·3	9 04·7	8 38·5	1·3	0·8	7·3	4·4	13·3	8·1
14	9 03·5	9 05·0	8 38·7	1·4	0·9	7·4	4·5	13·4	8·2
15	9 03·8	9 05·2	8 39·0	1·5	0·9	7·5	4·6	13·5	8·2
16	9 04·0	9 05·5	8 39·2	1·6	1·0	7·6	4·6	13·6	8·3
17	9 04·3	9 05·7	8 39·5	1·7	1·0	7·7	4·7	13·7	8·3
18	9 04·5	9 06·0	8 39·7	1·8	1·1	7·8	4·7	13·8	8·4
19	9 04·8	9 06·2	8 39·9	1·9	1·2	7·9	4·8	13·9	8·5
20	9 05·0	9 06·5	8 40·2	2·0	1·2	8·0	4·9	14·0	8·5
21	9 05·3	9 06·7	8 40·4	2·1	1·3	8·1	4·9	14·1	8·6
22	9 05·5	9 07·0	8 40·6	2·2	1·3	8·2	5·0	14·2	8·6
23	9 05·8	9 07·2	8 40·9	2·3	1·4	8·3	5·0	14·3	8·7
24	9 06·0	9 07·5	8 41·1	2·4	1·5	8·4	5·1	14·4	8·8
25	9 06·3	9 07·7	8 41·4	2·5	1·5	8·5	5·2	14·5	8·8
26	9 06·5	9 08·0	8 41·6	2·6	1·6	8·6	5·2	14·6	8·9
27	9 06·8	9 08·2	8 41·8	2·7	1·6	8·7	5·3	14·7	8·9
28	9 07·0	9 08·5	8 42·1	2·8	1·7	8·8	5·4	14·8	9·0
29	9 07·3	9 08·7	8 42·3	2·9	1·8	8·9	5·4	14·9	9·1
30	9 07·5	9 09·0	8 42·6	3·0	1·8	9·0	5·5	15·0	9·1
31	9 07·8	9 09·2	8 42·8	3·1	1·9	9·1	5·5	15·1	9·2
32	9 08·0	9 09·5	8 43·0	3·2	1·9	9·2	5·6	15·2	9·2
33	9 08·3	9 09·8	8 43·3	3·3	2·0	9·3	5·7	15·3	9·3
34	9 08·5	9 10·0	8 43·5	3·4	2·1	9·4	5·7	15·4	9·4
35	9 08·8	9 10·3	8 43·8	3·5	2·1	9·5	5·8	15·5	9·4
36	9 09·0	9 10·5	8 44·0	3·6	2·2	9·6	5·8	15·6	9·5
37	9 09·3	9 10·8	8 44·2	3·7	2·3	9·7	5·9	15·7	9·6
38	9 09·5	9 11·0	8 44·5	3·8	2·3	9·8	6·0	15·8	9·6
39	9 09·8	9 11·3	8 44·7	3·9	2·4	9·9	6·0	15·9	9·7
40	9 10·0	9 11·5	8 44·9	4·0	2·4	10·0	6·1	16·0	9·7
41	9 10·3	9 11·8	8 45·2	4·1	2·5	10·1	6·1	16·1	9·8
42	9 10·5	9 12·0	8 45·4	4·2	2·6	10·2	6·2	16·2	9·9
43	9 10·8	9 12·3	8 45·7	4·3	2·6	10·3	6·3	16·3	9·9
44	9 11·0	9 12·5	8 45·9	4·4	2·7	10·4	6·3	16·4	10·0
45	9 11·3	9 12·8	8 46·1	4·5	2·7	10·5	6·4	16·5	10·0
46	9 11·5	9 13·0	8 46·4	4·6	2·8	10·6	6·4	16·6	10·1
47	9 11·8	9 13·3	8 46·6	4·7	2·9	10·7	6·5	16·7	10·2
48	9 12·0	9 13·5	8 46·9	4·8	2·9	10·8	6·6	16·8	10·2
49	9 12·3	9 13·8	8 47·1	4·9	3·0	10·9	6·6	16·9	10·3
50	9 12·5	9 14·0	8 47·3	5·0	3·0	11·0	6·7	17·0	10·3
51	9 12·8	9 14·3	8 47·6	5·1	3·1	11·1	6·8	17·1	10·4
52	9 13·0	9 14·5	8 47·8	5·2	3·2	11·2	6·8	17·2	10·5
53	9 13·3	9 14·8	8 48·0	5·3	3·2	11·3	6·9	17·3	10·5
54	9 13·5	9 15·0	8 48·3	5·4	3·3	11·4	6·9	17·4	10·6
55	9 13·8	9 15·3	8 48·5	5·5	3·3	11·5	7·0	17·5	10·6
56	9 14·0	9 15·5	8 48·8	5·6	3·4	11·6	7·1	17·6	10·7
57	9 14·3	9 15·8	8 49·0	5·7	3·5	11·7	7·1	17·7	10·8
58	9 14·5	9 16·0	8 49·2	5·8	3·5	11·8	7·2	17·8	10·8
59	9 14·8	9 16·3	8 49·5	5·9	3·6	11·9	7·2	17·9	10·9
60	9 15·0	9 16·5	8 49·7	6·0	3·7	12·0	7·3	18·0	11·0

m 37	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	9 15·0	9 16·5	8 49·7	0·0	0·0	6·0	3·8	12·0	7·5
01	9 15·3	9 16·8	8 50·0	0·1	0·1	6·1	3·8	12·1	7·6
02	9 15·5	9 17·0	8 50·2	0·2	0·1	6·2	3·9	12·2	7·6
03	9 15·8	9 17·3	8 50·4	0·3	0·2	6·3	3·9	12·3	7·7
04	9 16·0	9 17·5	8 50·7	0·4	0·3	6·4	4·0	12·4	7·8
05	9 16·3	9 17·8	8 50·9	0·5	0·3	6·5	4·1	12·5	7·8
06	9 16·5	9 18·0	8 51·1	0·6	0·4	6·6	4·1	12·6	7·9
07	9 16·8	9 18·3	8 51·4	0·7	0·4	6·7	4·2	12·7	7·9
08	9 17·0	9 18·5	8 51·6	0·8	0·5	6·8	4·3	12·8	8·0
09	9 17·3	9 18·8	8 51·9	0·9	0·6	6·9	4·3	12·9	8·1
10	9 17·5	9 19·0	8 52·1	1·0	0·6	7·0	4·4	13·0	8·1
11	9 17·8	9 19·3	8 52·3	1·1	0·7	7·1	4·4	13·1	8·2
12	9 18·0	9 19·5	8 52·6	1·2	0·8	7·2	4·5	13·2	8·3
13	9 18·3	9 19·8	8 52·8	1·3	0·8	7·3	4·6	13·3	8·3
14	9 18·5	9 20·0	8 53·1	1·4	0·9	7·4	4·6	13·4	8·4
15	9 18·8	9 20·3	8 53·3	1·5	0·9	7·5	4·7	13·5	8·4
16	9 19·0	9 20·5	8 53·5	1·6	1·0	7·6	4·8	13·6	8·5
17	9 19·3	9 20·8	8 53·8	1·7	1·1	7·7	4·8	13·7	8·6
18	9 19·5	9 21·0	8 54·0	1·8	1·1	7·8	4·9	13·8	8·6
19	9 19·8	9 21·3	8 54·3	1·9	1·2	7·9	4·9	13·9	8·7
20	9 20·0	9 21·5	8 54·5	2·0	1·3	8·0	5·0	14·0	8·8
21	9 20·3	9 21·8	8 54·7	2·1	1·3	8·1	5·1	14·1	8·8
22	9 20·5	9 22·0	8 55·0	2·2	1·4	8·2	5·1	14·2	8·9
23	9 20·8	9 22·3	8 55·2	2·3	1·4	8·3	5·2	14·3	8·9
24	9 21·0	9 22·5	8 55·4	2·4	1·5	8·4	5·3	14·4	9·0
25	9 21·3	9 22·8	8 55·7	2·5	1·6	8·5	5·3	14·5	9·1
26	9 21·5	9 23·0	8 55·9	2·6	1·6	8·6	5·4	14·6	9·1
27	9 21·8	9 23·3	8 56·2	2·7	1·7	8·7	5·4	14·7	9·2
28	9 22·0	9 23·5	8 56·4	2·8	1·8	8·8	5·5	14·8	9·3
29	9 22·3	9 23·8	8 56·6	2·9	1·8	8·9	5·6	14·9	9·3
30	9 22·5	9 24·0	8 56·9	3·0	1·9	9·0	5·6	15·0	9·4
31	9 22·8	9 24·3	8 57·1	3·1	1·9	9·1	5·7	15·1	9·4
32	9 23·0	9 24·5	8 57·4	3·2	2·0	9·2	5·8	15·2	9·5
33	9 23·3	9 24·8	8 57·6	3·3	2·1	9·3	5·8	15·3	9·6
34	9 23·5	9 25·0	8 57·8	3·4	2·1	9·4	5·9	15·4	9·6
35	9 23·8	9 25·3	8 58·1	3·5	2·2	9·5	5·9	15·5	9·7
36	9 24·0	9 25·5	8 58·3	3·6	2·3	9·6	6·0	15·6	9·8
37	9 24·3	9 25·8	8 58·5	3·7	2·3	9·7	6·1	15·7	9·8
38	9 24·5	9 26·0	8 58·8	3·8	2·4	9·8	6·1	15·8	9·9
39	9 24·8	9 26·3	8 59·0	3·9	2·4	9·9	6·2	15·9	9·9
40	9 25·0	9 26·5	8 59·3	4·0	2·5	10·0	6·3	16·0	10·0
41	9 25·3	9 26·8	8 59·5	4·1	2·6	10·1	6·3	16·1	10·1
42	9 25·5	9 27·0	8 59·7	4·2	2·6	10·2	6·4	16·2	10·1
43	9 25·8	9 27·3	9 00·0	4·3	2·7	10·3	6·4	16·3	10·2
44	9 26·0	9 27·5	9 00·2	4·4	2·8	10·4	6·5	16·4	10·3
45	9 26·3	9 27·8	9 00·5	4·5	2·8	10·5	6·6	16·5	10·3
46	9 26·5	9 28·1	9 00·7	4·6	2·9	10·6	6·6	16·6	10·4
47	9 26·8	9 28·3	9 00·9	4·7	2·9	10·7	6·7	16·7	10·4
48	9 27·0	9 28·6	9 01·2	4·8	3·0	10·8	6·8	16·8	10·5
49	9 27·3	9 28·8	9 01·4	4·9	3·1	10·9	6·8	16·9	10·6
50	9 27·5	9 29·1	9 01·6	5·0	3·1	11·0	6·9	17·0	10·6
51	9 27·8	9 29·3	9 01·9	5·1	3·2	11·1	6·9	17·1	10·7
52	9 28·0	9 29·6	9 02·1	5·2	3·3	11·2	7·0	17·2	10·8
53	9 28·3	9 29·8	9 02·4	5·3	3·3	11·3	7·1	17·3	10·8
54	9 28·5	9 30·1	9 02·6	5·4	3·4	11·4	7·1	17·4	10·9
55	9 28·8	9 30·3	9 02·8	5·5	3·4	11·5	7·2	17·5	10·9
56	9 29·0	9 30·6	9 03·1	5·6	3·5	11·6	7·3	17·6	11·0
57	9 29·3	9 30·8	9 03·3	5·7	3·6	11·7	7·3	17·7	11·1
58	9 29·5	9 31·1	9 03·6	5·8	3·6	11·8	7·4	17·8	11·1
59	9 29·8	9 31·3	9 03·8	5·9	3·7	11·9	7·4	17·9	11·2
60	9 30·0	9 31·6	9 04·0	6·0	3·8	12·0	7·5	18·0	11·3

m 38	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	9 30·0	9 31·6	9 04·0	0·0	0·0	6·0	3·9	12·0	7·7
01	9 30·3	9 31·8	9 04·3	0·1	0·1	6·1	3·9	12·1	7·8
02	9 30·5	9 32·1	9 04·5	0·2	0·1	6·2	4·0	12·2	7·8
03	9 30·8	9 32·3	9 04·7	0·3	0·2	6·3	4·0	12·3	7·9
04	9 31·0	9 32·6	9 05·0	0·4	0·3	6·4	4·1	12·4	8·0
05	9 31·3	9 32·8	9 05·2	0·5	0·3	6·5	4·2	12·5	8·0
06	9 31·5	9 33·1	9 05·5	0·6	0·4	6·6	4·2	12·6	8·1
07	9 31·8	9 33·3	9 05·7	0·7	0·4	6·7	4·3	12·7	8·1
08	9 32·0	9 33·6	9 05·9	0·8	0·5	6·8	4·4	12·8	8·2
09	9 32·3	9 33·8	9 06·2	0·9	0·6	6·9	4·4	12·9	8·3
10	9 32·5	9 34·1	9 06·4	1·0	0·6	7·0	4·5	13·0	8·3
11	9 32·8	9 34·3	9 06·7	1·1	0·7	7·1	4·6	13·1	8·4
12	9 33·0	9 34·6	9 06·9	1·2	0·8	7·2	4·6	13·2	8·5
13	9 33·3	9 34·8	9 07·1	1·3	0·8	7·3	4·7	13·3	8·5
14	9 33·5	9 35·1	9 07·4	1·4	0·9	7·4	4·7	13·4	8·6
15	9 33·8	9 35·3	9 07·6	1·5	1·0	7·5	4·8	13·5	8·7
16	9 34·0	9 35·6	9 07·9	1·6	1·0	7·6	4·9	13·6	8·7
17	9 34·3	9 35·8	9 08·1	1·7	1·1	7·7	4·9	13·7	8·8
18	9 34·5	9 36·1	9 08·3	1·8	1·2	7·8	5·0	13·8	8·9
19	9 34·8	9 36·3	9 08·6	1·9	1·2	7·9	5·1	13·9	8·9
20	9 35·0	9 36·6	9 08·8	2·0	1·3	8·0	5·1	14·0	9·0
21	9 35·3	9 36·8	9 09·0	2·1	1·3	8·1	5·2	14·1	9·0
22	9 35·5	9 37·1	9 09·3	2·2	1·4	8·2	5·3	14·2	9·1
23	9 35·8	9 37·3	9 09·5	2·3	1·5	8·3	5·3	14·3	9·2
24	9 36·0	9 37·6	9 09·8	2·4	1·5	8·4	5·4	14·4	9·2
25	9 36·3	9 37·8	9 10·0	2·5	1·6	8·5	5·5	14·5	9·3
26	9 36·5	9 38·1	9 10·2	2·6	1·7	8·6	5·5	14·6	9·4
27	9 36·8	9 38·3	9 10·5	2·7	1·7	8·7	5·6	14·7	9·4
28	9 37·0	9 38·6	9 10·7	2·8	1·8	8·8	5·6	14·8	9·5
29	9 37·3	9 38·8	9 11·0	2·9	1·9	8·9	5·7	14·9	9·6
30	9 37·5	9 39·1	9 11·2	3·0	1·9	9·0	5·8	15·0	9·6
31	9 37·8	9 39·3	9 11·4	3·1	2·0	9·1	5·8	15·1	9·7
32	9 38·0	9 39·6	9 11·7	3·2	2·1	9·2	5·9	15·2	9·8
33	9 38·3	9 39·8	9 11·9	3·3	2·1	9·3	6·0	15·3	9·8
34	9 38·5	9 40·1	9 12·1	3·4	2·2	9·4	6·0	15·4	9·9
35	9 38·8	9 40·3	9 12·4	3·5	2·2	9·5	6·1	15·5	9·9
36	9 39·0	9 40·6	9 12·6	3·6	2·3	9·6	6·2	15·6	10·0
37	9 39·3	9 40·8	9 12·9	3·7	2·4	9·7	6·2	15·7	10·1
38	9 39·5	9 41·1	9 13·1	3·8	2·4	9·8	6·3	15·8	10·1
39	9 39·8	9 41·3	9 13·3	3·9	2·5	9·9	6·4	15·9	10·2
40	9 40·0	9 41·6	9 13·6	4·0	2·6	10·0	6·4	16·0	10·3
41	9 40·3	9 41·8	9 13·8	4·1	2·6	10·1	6·5	16·1	10·3
42	9 40·5	9 42·1	9 14·1	4·2	2·7	10·2	6·5	16·2	10·4
43	9 40·8	9 42·3	9 14·3	4·3	2·8	10·3	6·6	16·3	10·5
44	9 41·0	9 42·6	9 14·5	4·4	2·8	10·4	6·7	16·4	10·5
45	9 41·3	9 42·8	9 14·8	4·5	2·9	10·5	6·7	16·5	10·6
46	9 41·5	9 43·1	9 15·0	4·6	3·0	10·6	6·8	16·6	10·7
47	9 41·8	9 43·3	9 15·2	4·7	3·0	10·7	6·9	16·7	10·7
48	9 42·0	9 43·6	9 15·5	4·8	3·1	10·8	6·9	16·8	10·8
49	9 42·3	9 43·8	9 15·7	4·9	3·1	10·9	7·0	16·9	10·8
50	9 42·5	9 44·1	9 16·0	5·0	3·2	11·0	7·1	17·0	10·9
51	9 42·8	9 44·3	9 16·2	5·1	3·3	11·1	7·1	17·1	11·0
52	9 43·0	9 44·6	9 16·4	5·2	3·3	11·2	7·2	17·2	11·0
53	9 43·3	9 44·8	9 16·7	5·3	3·4	11·3	7·3	17·3	11·1
54	9 43·5	9 45·1	9 16·9	5·4	3·5	11·4	7·3	17·4	11·2
55	9 43·8	9 45·3	9 17·2	5·5	3·5	11·5	7·4	17·5	11·2
56	9 44·0	9 45·6	9 17·4	5·6	3·6	11·6	7·4	17·6	11·3
57	9 44·3	9 45·8	9 17·6	5·7	3·7	11·7	7·5	17·7	11·4
58	9 44·5	9 46·1	9 17·9	5·8	3·7	11·8	7·6	17·8	11·4
59	9 44·8	9 46·4	9 18·1	5·9	3·8	11·9	7·6	17·9	11·5
60	9 45·0	9 46·6	9 18·4	6·0	3·9	12·0	7·7	18·0	11·6

m 39	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	9 45·0	9 46·6	9 18·4	0·0	0·0	6·0	4·0	12·0	7·9
01	9 45·3	9 46·9	9 18·6	0·1	0·1	6·1	4·0	12·1	8·0
02	9 45·5	9 47·1	9 18·8	0·2	0·1	6·2	4·1	12·2	8·0
03	9 45·8	9 47·4	9 19·1	0·3	0·2	6·3	4·1	12·3	8·1
04	9 46·0	9 47·6	9 19·3	0·4	0·3	6·4	4·2	12·4	8·2
05	9 46·3	9 47·9	9 19·5	0·5	0·3	6·5	4·3	12·5	8·2
06	9 46·5	9 48·1	9 19·8	0·6	0·4	6·6	4·3	12·6	8·3
07	9 46·8	9 48·4	9 20·0	0·7	0·5	6·7	4·4	12·7	8·4
08	9 47·0	9 48·6	9 20·3	0·8	0·5	6·8	4·5	12·8	8·4
09	9 47·3	9 48·9	9 20·5	0·9	0·6	6·9	4·5	12·9	8·5
10	9 47·5	9 49·1	9 20·7	1·0	0·7	7·0	4·6	13·0	8·6
11	9 47·8	9 49·4	9 21·0	1·1	0·7	7·1	4·7	13·1	8·6
12	9 48·0	9 49·6	9 21·2	1·2	0·8	7·2	4·7	13·2	8·7
13	9 48·3	9 49·9	9 21·5	1·3	0·9	7·3	4·8	13·3	8·8
14	9 48·5	9 50·1	9 21·7	1·4	0·9	7·4	4·9	13·4	8·8
15	9 48·8	9 50·4	9 21·9	1·5	1·0	7·5	4·9	13·5	8·9
16	9 49·0	9 50·6	9 22·2	1·6	1·1	7·6	5·0	13·6	9·0
17	9 49·3	9 50·9	9 22·4	1·7	1·1	7·7	5·1	13·7	9·0
18	9 49·5	9 51·1	9 22·6	1·8	1·2	7·8	5·1	13·8	9·1
19	9 49·8	9 51·4	9 22·9	1·9	1·3	7·9	5·2	13·9	9·2
20	9 50·0	9 51·6	9 23·1	2·0	1·3	8·0	5·3	14·0	9·2
21	9 50·3	9 51·9	9 23·4	2·1	1·4	8·1	5·3	14·1	9·3
22	9 50·5	9 52·1	9 23·6	2·2	1·4	8·2	5·4	14·2	9·3
23	9 50·8	9 52·4	9 23·8	2·3	1·5	8·3	5·5	14·3	9·4
24	9 51·0	9 52·6	9 24·1	2·4	1·6	8·4	5·5	14·4	9·5
25	9 51·3	9 52·9	9 24·3	2·5	1·6	8·5	5·6	14·5	9·5
26	9 51·5	9 53·1	9 24·6	2·6	1·7	8·6	5·7	14·6	9·6
27	9 51·8	9 53·4	9 24·8	2·7	1·8	8·7	5·7	14·7	9·7
28	9 52·0	9 53·6	9 25·0	2·8	1·8	8·8	5·8	14·8	9·7
29	9 52·3	9 53·9	9 25·3	2·9	1·9	8·9	5·9	14·9	9·8
30	9 52·5	9 54·1	9 25·5	3·0	2·0	9·0	5·9	15·0	9·9
31	9 52·8	9 54·4	9 25·7	3·1	2·0	9·1	6·0	15·1	9·9
32	9 53·0	9 54·6	9 26·0	3·2	2·1	9·2	6·1	15·2	10·0
33	9 53·3	9 54·9	9 26·2	3·3	2·2	9·3	6·1	15·3	10·1
34	9 53·5	9 55·1	9 26·5	3·4	2·2	9·4	6·2	15·4	10·1
35	9 53·8	9 55·4	9 26·7	3·5	2·3	9·5	6·3	15·5	10·2
36	9 54·0	9 55·6	9 26·9	3·6	2·4	9·6	6·3	15·6	10·3
37	9 54·3	9 55·9	9 27·2	3·7	2·4	9·7	6·4	15·7	10·3
38	9 54·5	9 56·1	9 27·4	3·8	2·5	9·8	6·5	15·8	10·4
39	9 54·8	9 56·4	9 27·7	3·9	2·6	9·9	6·5	15·9	10·5
40	9 55·0	9 56·6	9 27·9	4·0	2·6	10·0	6·6	16·0	10·5
41	9 55·3	9 56·9	9 28·1	4·1	2·7	10·1	6·6	16·1	10·6
42	9 55·5	9 57·1	9 28·4	4·2	2·8	10·2	6·7	16·2	10·7
43	9 55·8	9 57·4	9 28·6	4·3	2·8	10·3	6·8	16·3	10·7
44	9 56·0	9 57·6	9 28·8	4·4	2·9	10·4	6·8	16·4	10·8
45	9 56·3	9 57·9	9 29·1	4·5	3·0	10·5	6·9	16·5	10·9
46	9 56·5	9 58·1	9 29·3	4·6	3·0	10·6	7·0	16·6	10·9
47	9 56·8	9 58·4	9 29·6	4·7	3·1	10·7	7·0	16·7	11·0
48	9 57·0	9 58·6	9 29·8	4·8	3·2	10·8	7·1	16·8	11·1
49	9 57·3	9 58·9	9 30·0	4·9	3·2	10·9	7·2	16·9	11·1
50	9 57·5	9 59·1	9 30·3	5·0	3·3	11·0	7·2	17·0	11·2
51	9 57·8	9 59·4	9 30·5	5·1	3·4	11·1	7·3	17·1	11·3
52	9 58·0	9 59·6	9 30·8	5·2	3·4	11·2	7·4	17·2	11·3
53	9 58·3	9 59·9	9 31·0	5·3	3·5	11·3	7·4	17·3	11·4
54	9 58·5	10 00·1	9 31·2	5·4	3·6	11·4	7·5	17·4	11·5
55	9 58·8	10 00·4	9 31·5	5·5	3·6	11·5	7·6	17·5	11·5
56	9 59·0	10 00·6	9 31·7	5·6	3·7	11·6	7·6	17·6	11·6
57	9 59·3	10 00·9	9 32·0	5·7	3·8	11·7	7·7	17·7	11·7
58	9 59·5	10 01·1	9 32·2	5·8	3·8	11·8	7·8	17·8	11·7
59	9 59·8	10 01·4	9 32·4	5·9	3·9	11·9	7·8	17·9	11·8
60	10 00·0	10 01·6	9 32·7	6·0	4·0	12·0	7·9	18·0	11·9

m 40	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	° ′	° ′	° ′	′	′	′	′	′	′
00	10 00·0	10 01·6	9 32·7	0·0	0·0	6·0	4·1	12·0	8·1
01	10 00·3	10 01·9	9 32·9	0·1	0·1	6·1	4·1	12·1	8·2
02	10 00·5	10 02·1	9 33·1	0·2	0·1	6·2	4·2	12·2	8·2
03	10 00·8	10 02·4	9 33·4	0·3	0·2	6·3	4·3	12·3	8·3
04	10 01·0	10 02·6	9 33·6	0·4	0·3	6·4	4·3	12·4	8·4
05	10 01·3	10 02·9	9 33·9	0·5	0·3	6·5	4·4	12·5	8·4
06	10 01·5	10 03·1	9 34·1	0·6	0·4	6·6	4·5	12·6	8·5
07	10 01·8	10 03·4	9 34·3	0·7	0·5	6·7	4·5	12·7	8·6
08	10 02·0	10 03·6	9 34·6	0·8	0·5	6·8	4·6	12·8	8·6
09	10 02·3	10 03·9	9 34·8	0·9	0·6	6·9	4·7	12·9	8·7
10	10 02·5	10 04·1	9 35·1	1·0	0·7	7·0	4·7	13·0	8·8
11	10 02·8	10 04·4	9 35·3	1·1	0·7	7·1	4·8	13·1	8·8
12	10 03·0	10 04·7	9 35·5	1·2	0·8	7·2	4·9	13·2	8·9
13	10 03·3	10 04·9	9 35·8	1·3	0·9	7·3	4·9	13·3	9·0
14	10 03·5	10 05·2	9 36·0	1·4	0·9	7·4	5·0	13·4	9·0
15	10 03·8	10 05·4	9 36·2	1·5	1·0	7·5	5·1	13·5	9·1
16	10 04·0	10 05·7	9 36·5	1·6	1·1	7·6	5·1	13·6	9·2
17	10 04·3	10 05·9	9 36·7	1·7	1·1	7·7	5·2	13·7	9·2
18	10 04·5	10 06·2	9 37·0	1·8	1·2	7·8	5·3	13·8	9·3
19	10 04·8	10 06·4	9 37·2	1·9	1·3	7·9	5·3	13·9	9·4
20	10 05·0	10 06·7	9 37·4	2·0	1·4	8·0	5·4	14·0	9·5
21	10 05·3	10 06·9	9 37·7	2·1	1·4	8·1	5·5	14·1	9·5
22	10 05·5	10 07·2	9 37·9	2·2	1·5	8·2	5·5	14·2	9·6
23	10 05·8	10 07·4	9 38·2	2·3	1·6	8·3	5·6	14·3	9·7
24	10 06·0	10 07·7	9 38·4	2·4	1·6	8·4	5·7	14·4	9·7
25	10 06·3	10 07·9	9 38·6	2·5	1·7	8·5	5·7	14·5	9·8
26	10 06·5	10 08·2	9 38·9	2·6	1·8	8·6	5·8	14·6	9·9
27	10 06·8	10 08·4	9 39·1	2·7	1·8	8·7	5·9	14·7	9·9
28	10 07·0	10 08·7	9 39·3	2·8	1·9	8·8	5·9	14·8	10·0
29	10 07·3	10 08·9	9 39·6	2·9	2·0	8·9	6·0	14·9	10·1
30	10 07·5	10 09·2	9 39·8	3·0	2·0	9·0	6·1	15·0	10·1
31	10 07·8	10 09·4	9 40·1	3·1	2·1	9·1	6·1	15·1	10·2
32	10 08·0	10 09·7	9 40·3	3·2	2·2	9·2	6·2	15·2	10·3
33	10 08·3	10 09·9	9 40·5	3·3	2·2	9·3	6·3	15·3	10·3
34	10 08·5	10 10·2	9 40 8	3·4	2·3	9·4	6·3	15·4	10·4
35	10 08·8	10 10·4	9 41·0	3·5	2·4	9·5	6·4	15·5	10·5
36	10 09·0	10 10·7	9 41·3	3·6	2·4	9·6	6·5	15·6	10·5
37	10 09·3	10 10·9	9 41·5	3·7	2·5	9·7	6·5	15·7	10·6
38	10 09·5	10 11·2	9 41·7	3·8	2·6	9·8	6·6	15·8	10·7
39	10 09·8	10 11·4	9 42·0	3·9	2·6	9·9	6·7	15·9	10·7
40	10 10·0	10 11·7	9 42·2	4·0	2·7	10·0	6·8	16·0	10·8
41	10 10·3	10 11·9	9 42·4	4·1	2·8	10·1	6·8	16·1	10·9
42	10 10·5	10 12·2	9 42·7	4·2	2·8	10·2	6·9	16·2	10·9
43	10 10·8	10 12·4	9 42·9	4·3	2·9	10·3	7·0	16·3	11·0
44	10 11·0	10 12·7	9 43·2	4·4	3·0	10·4	7·0	16·4	11·1
45	10 11·3	10 12·9	9 43·4	4·5	3·0	10·5	7·1	16·5	11·1
46	10 11·5	10 13·2	9 43·6	4·6	3·1	10·6	7·2	16·6	11·2
47	10 11·8	10 13·4	9 43·9	4·7	3·2	10·7	7·2	16·7	11·3
48	10 12·0	10 13·7	9 44·1	4·8	3·2	10·8	7·3	16·8	11·3
49	10 12·3	10 13·9	9 44·4	4·9	3·3	10·9	7·4	16·9	11·4
50	10 12·5	10 14·2	9 44·6	5·0	3·4	11·0	7·4	17·0	11·5
51	10 12·8	10 14·4	9 44·8	5·1	3·4	11·1	7·5	17·1	11·5
52	10 13·0	10 14·7	9 45·1	5·2	3·5	11·2	7·6	17·2	11·6
53	10 13·3	10 14·9	9 45·3	5·3	3·6	11·3	7·6	17·3	11·7
54	10 13·5	10 15·2	9 45·6	5·4	3·6	11·4	7·7	17·4	11·7
55	10 13·8	10 15·4	9 45·8	5·5	3·7	11·5	7·8	17·5	11·8
56	10 14·0	10 15·7	9 46·0	5·6	3·8	11·6	7·8	17·6	11 9
57	10 14·3	10 15·9	9 46·3	5·7	3·8	11·7	7·9	17·7	11·9
58	10 14·5	10 16·2	9 46·5	5·8	3·9	11·8	8·0	17·8	12·0
59	10 14·8	10 16·4	9 46·7	5·9	4·0	11·9	8·0	17·9	12·1
60	10 15·0	10 16·7	9 47·0	6·0	4·1	12·0	8·1	18·0	12·2

m 41	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	° ′	° ′	° ′	′	′	′	′	′	′
00	10 15·0	10 16·7	9 47·0	0·0	0·0	6·0	4·2	12·0	8·3
01	10 15·3	10 16·9	9 47·2	0·1	0·1	6·1	4·2	12·1	8·4
02	10 15·5	10 17·2	9 47·5	0·2	0·1	6·2	4·3	12·2	8·4
03	10 15·8	10 17·4	9 47·7	0·3	0·2	6·3	4·4	12·3	8·5
04	10 16·0	10 17·7	9 47·9	0·4	0·3	6·4	4·4	12·4	8·6
05	10 16·3	10 17·9	9 48·2	0·5	0·3	6·5	4·5	12·5	8·6
06	10 16·5	10 18·2	9 48·4	0·6	0·4	6·6	4·6	12·6	8·7
07	10 16·8	10 18·4	9 48·7	0·7	0·5	6·7	4·6	12·7	8·8
08	10 17·0	10 18·7	9 48·9	0·8	0·6	6·8	4·7	12·8	8·9
09	10 17·3	10 18·9	9 49·1	0·9	0·6	6·9	4·8	12·9	8·9
10	10 17·5	10 19·2	9 49·4	1·0	0·7	7·0	4·8	13·0	9·0
11	10 17·8	10 19·4	9 49·6	1·1	0·8	7·1	4·9	13·1	9·1
12	10 18·0	10 19·7	9 49·8	1·2	0·8	7·2	5·0	13·2	9·1
13	10 18·3	10 19·9	9 50·1	1·3	0·9	7·3	5·0	13·3	9·2
14	10 18·5	10 20·2	9 50·3	1·4	1·0	7·4	5·1	13·4	9·3
15	10 18·8	10 20·4	9 50·6	1·5	1·0	7·5	5·2	13·5	9·3
16	10 19·0	10 20·7	9 50·8	1·6	1·1	7·6	5·3	13·6	9·4
17	10 19·3	10 20·9	9 51·0	1·7	1·2	7·7	5·3	13·7	9·5
18	10 19·5	10 21·2	9 51·3	1·8	1·2	7·8	5·4	13·8	9·5
19	10 19·8	10 21·4	9 51·5	1·9	1·3	7·9	5·5	13·9	9·6
20	10 20·0	10 21·7	9 51·8	2·0	1·4	8·0	5·5	14·0	9·7
21	10 20·3	10 21·9	9 52·0	2·1	1·5	8·1	5·6	14·1	9·8
22	10 20·5	10 22·2	9 52·2	2·2	1·5	8·2	5·7	14·2	9·8
23	10 20·8	10 22·4	9 52·5	2·3	1·6	8·3	5·7	14·3	9·9
24	10 21·0	10 22·7	9 52·7	2·4	1·7	8·4	5·8	14·4	10·0
25	10 21·3	10 23·0	9 52·9	2·5	1·7	8·5	5·9	14·5	10·0
26	10 21·5	10 23·2	9 53·2	2·6	1·8	8·6	5·9	14·6	10·1
27	10 21·8	10 23·5	9 53·4	2·7	1·9	8·7	6·0	14·7	10·2
28	10 22·0	10 23·7	9 53·7	2·8	1·9	8·8	6·1	14·8	10·2
29	10 22·3	10 24·0	9 53·9	2·9	2·0	8·9	6·2	14·9	10·3
30	10 22·5	10 24·2	9 54·1	3·0	2·1	9·0	6·2	15·0	10·4
31	10 22·8	10 24·5	9 54·4	3·1	2·1	9·1	6·3	15·1	10·4
32	10 23·0	10 24·7	9 54·6	3·2	2·2	9·2	6·4	15·2	10·5
33	10 23·3	10 25·0	9 54·9	3·3	2·3	9·3	6·4	15·3	10·6
34	10 23·5	10 25·2	9 55·1	3·4	2·4	9·4	6·5	15·4	10·7
35	10 23·8	10 25·5	9 55·3	3·5	2·4	9·5	6·6	15·5	10·7
36	10 24·0	10 25·7	9 55·6	3·6	2·5	9·6	6·6	15·6	10·8
37	10 24·3	10 26·0	9 55·8	3·7	2·6	9·7	6·7	15·7	10·9
38	10 24·5	10 26·2	9 56·1	3·8	2·6	9·8	6·8	15·8	10·9
39	10 24·8	10 26·5	9 56·3	3·9	2·7	9·9	6·8	15·9	11·0
40	10 25·0	10 26·7	9 56·5	4·0	2·8	10·0	6·9	16·0	11·1
41	10 25·3	10 27·0	9 56·8	4·1	2·8	10·1	7·0	16·1	11·1
42	10 25·5	10 27·2	9 57·0	4·2	2·9	10·2	7·1	16·2	11·2
43	10 25·8	10 27·5	9 57·2	4·3	3·0	10·3	7·1	16·3	11·3
44	10 26·0	10 27·7	9 57·5	4·4	3·0	10·4	7·2	16·4	11·3
45	10 26·3	10 28·0	9 57·7	4·5	3·1	10·5	7·3	16·5	11·4
46	10 26·5	10 28·2	9 58·0	4·6	3·2	10·6	7·3	16·6	11·5
47	10 26·8	10 28·5	9 58·2	4·7	3·3	10·7	7·4	16·7	11·6
48	10 27·0	10 28·7	9 58·4	4·8	3·3	10·8	7·5	16·8	11·6
49	10 27·3	10 29·0	9 58·7	4·9	3·4	10·9	7·5	16·9	11·7
50	10 27·5	10 29·2	9 58·9	5·0	3·5	11·0	7·6	17·0	11·8
51	10 27·8	10 29·5	9 59·2	5·1	3·5	11·1	7·7	17·1	11·8
52	10 28·0	10 29·7	9 59·4	5·2	3·6	11·2	7·7	17·2	11·9
53	10 28·3	10 30·0	9 59·6	5·3	3·7	11·3	7·8	17·3	12·0
54	10 28·5	10 30·2	9 59·9	5·4	3·7	11·4	7·9	17·4	12·0
55	10 28·8	10 30·5	10 00·1	5·5	3·8	11·5	8·0	17·5	12·1
56	10 29·0	10 30·7	10 00·3	5·6	3·9	11·6	8·0	17·6	12·2
57	10 29·3	10 31·0	10 00·6	5·7	3·9	11·7	8·1	17·7	12·2
58	10 29·5	10 31·2	10 00·8	5·8	4·0	11·8	8·2	17·8	12·3
59	10 29·8	10 31·5	10 01·1	5·9	4 1	11·9	8·2	17·9	12·4
60	10 30·0	10 31·7	10 01·3	6·0	4·2	12·0	8·3	18·0	12·5

m 42	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	° ′	° ′	° ′	′	′	′	′	′	′
00	10 30·0	10 31·7	10 01·3	0·0	0·0	6·0	4·3	12·0	8·5
01	10 30·3	10 32·0	10 01·5	0·1	0·1	6·1	4·3	12·1	8·6
02	10 30·5	10 32·2	10 01·8	0·2	0·1	6·2	4·4	12·2	8·6
03	10 30·8	10 32·5	10 02·0	0·3	0·2	6·3	4·5	12·3	8·7
04	10 31·0	10 32·7	10 02·3	0·4	0·3	6·4	4·5	12·4	8·8
05	10 31·3	10 33·0	10 02·5	0·5	0·4	6·5	4·6	12·5	8·9
06	10 31·5	10 33·2	10 02·7	0·6	0·4	6·6	4·7	12·6	8·9
07	10 31·8	10 33·5	10 03·0	0·7	0·5	6·7	4·7	12·7	9·0
08	10 32·0	10 33·7	10 03·2	0·8	0·6	6·8	4·8	12·8	9·1
09	10 32·3	10 34·0	10 03·4	0·9	0·6	6·9	4·9	12·9	9·1
10	10 32·5	10 34·2	10 03·7	1·0	0·7	7·0	5·0	13·0	9·2
11	10 32·8	10 34·5	10 03·9	1·1	0·8	7·1	5·0	13·1	9·3
12	10 33·0	10 34·7	10 04·2	1·2	0·9	7·2	5·1	13·2	9·4
13	10 33·3	10 35·0	10 04·4	1·3	0·9	7·3	5·2	13·3	9·4
14	10 33·5	10 35·2	10 04·6	1·4	1·0	7·4	5·2	13·4	9·5
15	10 33·8	10 35·5	10 04·9	1·5	1·1	7·5	5·3	13·5	9·6
16	10 34·0	10 35·7	10 05·1	1·6	1·1	7·6	5·4	13·6	9·6
17	10 34·3	10 36·0	10 05·4	1·7	1·2	7·7	5·5	13·7	9·7
18	10 34·5	10 36·2	10 05·6	1·8	1·3	7·8	5·5	13·8	9·8
19	10 34·8	10 36·5	10 05·8	1·9	1·3	7·9	5·6	13·9	9·8
20	10 35·0	10 36·7	10 06·1	2·0	1·4	8·0	5·7	14·0	9·9
21	10 35·3	10 37·0	10 06·3	2·1	1·5	8·1	5·7	14·1	10·0
22	10 35·5	10 37·2	10 06·5	2·2	1·6	8·2	5·8	14·2	10·1
23	10 35·8	10 37·5	10 06·8	2·3	1·6	8·3	5·9	14·3	10·1
24	10 36·0	10 37·7	10 07·0	2·4	1·7	8·4	6·0	14·4	10·2
25	10 36·3	10 38·0	10 07·3	2·5	1·8	8·5	6·0	14·5	10·3
26	10 36·5	10 38·2	10 07·5	2·6	1·8	8·6	6·1	14·6	10·3
27	10 36·8	10 38·5	10 07·7	2·7	1·9	8·7	6·2	14·7	10·4
28	10 37·0	10 38·7	10 08·0	2·8	2·0	8·8	6·2	14·8	10·5
29	10 37·3	10 39·0	10 08·2	2·9	2·1	8·9	6·3	14·9	10·6
30	10 37·5	10 39·2	10 08·5	3·0	2·1	9·0	6·4	15·0	10·6
31	10 37·8	10 39·5	10 08·7	3·1	2·2	9·1	6·4	15·1	10·7
32	10 38·0	10 39·7	10 08·9	3·2	2·3	9·2	6·5	15·2	10·8
33	10 38·3	10 40·0	10 09·2	3·3	2·3	9·3	6·6	15·3	10·8
34	10 38·5	10 40·2	10 09·4	3·4	2·4	9·4	6·7	15·4	10·9
35	10 38·8	10 40·5	10 09·7	3·5	2·5	9·5	6·7	15·5	11·0
36	10 39·0	10 40·7	10 09·9	3·6	2·6	9·6	6·8	15·6	11·1
37	10 39·3	10 41·0	10 10·1	3·7	2·6	9·7	6·9	15·7	11·1
38	10 39·5	10 41·3	10 10·4	3·8	2·7	9·8	6·9	15·8	11·2
39	10 39·8	10 41·5	10 10·6	3·9	2·8	9·9	7·0	15·9	11·3
40	10 40·0	10 41·8	10 10·8	4·0	2·8	10·0	7·1	16·0	11·3
41	10 40·3	10 42·0	10 11·1	4·1	2·9	10·1	7·2	16·1	11·4
42	10 40·5	10 42·3	10 11·3	4·2	3·0	10·2	7·2	16·2	11·5
43	10 40·8	10 42·5	10 11·6	4·3	3·0	10·3	7·3	16·3	11·5
44	10 41·0	10 42·8	10 11·8	4·4	3·1	10·4	7·4	16·4	11·6
45	10 41·3	10 43·0	10 12·0	4·5	3·2	10·5	7·4	16·5	11·7
46	10 41·5	10 43·3	10 12·3	4·6	3·3	10·6	7·5	16·6	11·8
47	10 41·8	10 43·5	10 12·5	4·7	3·3	10·7	7·6	16·7	11·8
48	10 42·0	10 43·8	10 12·8	4·8	3·4	10·8	7·7	16·8	11·9
49	10 42·3	10 44·0	10 13·0	4·9	3·5	10·9	7·7	16·9	12·0
50	10 42·5	10 44·3	10 13·2	5·0	3·5	11·0	7·8	17·0	12·0
51	10 42·8	10 44·5	10 13·5	5·1	3·6	11·1	7·9	17·1	12·1
52	10 43·0	10 44·8	10 13·7	5·2	3·7	11·2	7·9	17·2	12·2
53	10 43·3	10 45·0	10 13·9	5·3	3·8	11·3	8·0	17·3	12·3
54	10 43·5	10 45·3	10 14·2	5·4	3·8	11·4	8·1	17·4	12·3
55	10 43·8	10 45·5	10 14·4	5·5	3·9	11·5	8·1	17·5	12·4
56	10 44·0	10 45·8	10 14·7	5·6	4·0	11·6	8·2	17·6	12·5
57	10 44·3	10 46·0	10 14·9	5·7	4·0	11·7	8·3	17·7	12·5
58	10 44·5	10 46·3	10 15·1	5·8	4·1	11·8	8·4	17·8	12·6
59	10 44·8	10 46·5	10 15·4	5·9	4·2	11·9	8·4	17·9	12·7
60	10 45·0	10 46·8	10 15·6	6·0	4·3	12·0	8·5	18·0	12·8

m 43	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	° ′	° ′	° ′	′	′	′	′	′	′
00	10 45·0	10 46·8	10 15·6	0·0	0·0	6·0	4·4	12·0	8·7
01	10 45·3	10 47·0	10 15·9	0·1	0·1	6·1	4·4	12·1	8·8
02	10 45·5	10 47·3	10 16·1	0·2	0·1	6·2	4·5	12·2	8·8
03	10 45·8	10 47·5	10 16·3	0·3	0·2	6·3	4·6	12·3	8·9
04	10 46·0	10 47·8	10 16·6	0·4	0·3	6·4	4·6	12·4	9·0
05	10 46·3	10 48·0	10 16·8	0·5	0·4	6·5	4·7	12·5	9·1
06	10 46·5	10 48·3	10 17·0	0·6	0·4	6·6	4·8	12·6	9·1
07	10 46·8	10 48·5	10 17·3	0·7	0·5	6·7	4·9	12·7	9·2
08	10 47·0	10 48·8	10 17·5	0·8	0·6	6·8	4·9	12·8	9·3
09	10 47·3	10 49·0	10 17·8	0·9	0·7	6·9	5·0	12·9	9·4
10	10 47·5	10 49·3	10 18·0	1·0	0·7	7·0	5·1	13·0	9·4
11	10 47·8	10 49·5	10 18·2	1·1	0·8	7·1	5·1	13·1	9·5
12	10 48·0	10 49·8	10 18·5	1·2	0·9	7·2	5·2	13·2	9·6
13	10 48·3	10 50·0	10 18·7	1·3	0·9	7·3	5·3	13·3	9·6
14	10 48·5	10 50·3	10 19·0	1·4	1·0	7·4	5·4	13·4	9·7
15	10 48·8	10 50·5	10 19·2	1·5	1·1	7·5	5·4	13·5	9·8
16	10 49·0	10 50·8	10 19·4	1·6	1·2	7·6	5·5	13·6	9·9
17	10 49·3	10 51·0	10 19·7	1·7	1·2	7·7	5·6	13·7	9·9
18	10 49·5	10 51·3	10 19·9	1·8	1·3	7·8	5·7	13·8	10·0
19	10 49·8	10 51·5	10 20·2	1·9	1·4	7·9	5·7	13·9	10·1
20	10 50·0	10 51·8	10 20·4	2·0	1·5	8·0	5·8	14·0	10·2
21	10 50·3	10 52·0	10 20·6	2·1	1·5	8·1	5·9	14·1	10·2
22	10 50·5	10 52·3	10 20·9	2·2	1·6	8·2	5·9	14·2	10·3
23	10 50·8	10 52·5	10 21·1	2·3	1·7	8·3	6·0	14·3	10·4
24	10 51·0	10 52·8	10 21·3	2·4	1·7	8·4	6·1	14·4	10·4
25	10 51·3	10 53·0	10 21·6	2·5	1·8	8·5	6·2	14·5	10·5
26	10 51·5	10 53·3	10 21·8	2·6	1·9	8·6	6·2	14·6	10·6
27	10 51·8	10 53·5	10 22·1	2·7	2·0	8·7	6·3	14·7	10·7
28	10 52·0	10 53·8	10 22·3	2·8	2·0	8·8	6·4	14·8	10·7
29	10 52·3	10 54·0	10 22·5	2·9	2·1	8·9	6·5	14·9	10·8
30	10 52·5	10 54·3	10 22·8	3·0	2·2	9·0	6·5	15·0	10·9
31	10 52·8	10 54·5	10 23·0	3·1	2·2	9·1	6·6	15·1	10·9
32	10 53·0	10 54·8	10 23·3	3·2	2·3	9·2	6·7	15·2	11·0
33	10 53·3	10 55·0	10 23·5	3·3	2·4	9·3	6·7	15·3	11·1
34	10 53·5	10 55·3	10 23·7	3·4	2·5	9·4	6·8	15·4	11·2
35	10 53·8	10 55·5	10 24·0	3·5	2·5	9·5	6·9	15·5	11·2
36	10 54·0	10 55·8	10 24·2	3·6	2·6	9·6	7·0	15·6	11·3
37	10 54·3	10 56·0	10 24·4	3·7	2·7	9·7	7·0	15·7	11·4
38	10 54·5	10 56·3	10 24·7	3·8	2·8	9·8	7·1	15·8	11·5
39	10 54·8	10 56·5	10 24·9	3·9	2·8	9·9	7·2	15·9	11·5
40	10 55·0	10 56·8	10 25·2	4·0	2·9	10·0	7·3	16·0	11·6
41	10 55·3	10 57·0	10 25·4	4·1	3·0	10·1	7·3	16·1	11·7
42	10 55·5	10 57·3	10 25·6	4·2	3·0	10·2	7·4	16·2	11·7
43	10 55·8	10 57·5	10 25·9	4·3	3·1	10·3	7·5	16·3	11·8
44	10 56·0	10 57·8	10 26·1	4·4	3·2	10·4	7·5	16·4	11·9
45	10 56·3	10 58·0	10 26·4	4·5	3·3	10·5	7·6	16·5	12·0
46	10 56·5	10 58·3	10 26·6	4·6	3·3	10·6	7·7	16·6	12·0
47	10 56·8	10 58·5	10 26·8	4·7	3·4	10·7	7·8	16·7	12·1
48	10 57·0	10 58·8	10 27·1	4·8	3·5	10·8	7·8	16·8	12·2
49	10 57·3	10 59·0	10 27·3	4·9	3·6	10·9	7·9	16·9	12·3
50	10 57·5	10 59·3	10 27·5	5·0	3·6	11·0	8·0	17·0	12·3
51	10 57·8	10 59·6	10 27·8	5·1	3·7	11·1	8·0	17·1	12·4
52	10 58·0	10 59·8	10 28·0	5·2	3·8	11·2	8·1	17·2	12·5
53	10 58·3	11 00·1	10 28·3	5·3	3·8	11·3	8·2	17·3	12·5
54	10 58·5	11 00·3	10 28·5	5·4	3·9	11·4	8·3	17·4	12·6
55	10 58·8	11 00·6	10 28·7	5·5	4·0	11·5	8·3	17·5	12·7
56	10 59·0	11 00·8	10 29·0	5·6	4·1	11·6	8·4	17·6	12·8
57	10 59·3	11 01·1	10 29·2	5·7	4·1	11·7	8·5	17·7	12·8
58	10 59·5	11 01·3	10 29·5	5·8	4·2	11·8	8·6	17·8	12·9
59	10 59·8	11 01·6	10 29·7	5·9	4·3	11·9	8·6	17·9	13·0
60	11 00·0	11 01·8	10 29·9	6·0	4·4	12·0	8·7	18·0	13·1

44m	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	11 00·0	11 01·8	10 29·9	0·0	0·0	6·0	4·5	12·0	8·9
01	11 00·3	11 02·1	10 30·2	0·1	0·1	6·1	4·5	12·1	9·0
02	11 00·5	11 02·3	10 30·4	0·2	0·1	6·2	4·6	12·2	9·0
03	11 00·8	11 02·6	10 30·6	0·3	0·2	6·3	4·7	12·3	9·1
04	11 01·0	11 02·8	10 30·9	0·4	0·3	6·4	4·7	12·4	9·2
05	11 01·3	11 03·1	10 31·1	0·5	0·4	6·5	4·8	12·5	9·3
06	11 01·5	11 03·3	10 31·4	0·6	0·4	6·6	4·9	12·6	9·3
07	11 01·8	11 03·6	10 31·6	0·7	0·5	6·7	5·0	12·7	9·4
08	11 02·0	11 03·8	10 31·8	0·8	0·6	6·8	5·0	12·8	9·5
09	11 02·3	11 04·1	10 32·1	0·9	0·7	6·9	5·1	12·9	9·6
10	11 02·5	11 04·3	10 32·3	1·0	0·7	7·0	5·2	13·0	9·6
11	11 02·8	11 04·6	10 32·6	1·1	0·8	7·1	5·3	13·1	9·7
12	11 03·0	11 04·8	10 32·8	1·2	0·9	7·2	5·3	13·2	9·8
13	11 03·3	11 05·1	10 33·0	1·3	1·0	7·3	5·4	13·3	9·9
14	11 03·5	11 05·3	10 33·3	1·4	1·0	7·4	5·5	13·4	9·9
15	11 03·8	11 05·6	10 33·5	1·5	1·1	7·5	5·6	13·5	10·0
16	11 04·0	11 05·8	10 33·8	1·6	1·2	7·6	5·6	13·6	10·1
17	11 04·3	11 06·1	10 34·0	1·7	1·3	7·7	5·7	13·7	10·2
18	11 04·5	11 06·3	10 34·2	1·8	1·3	7·8	5·8	13·8	10·2
19	11 04·8	11 06·6	10 34·5	1·9	1·4	7·9	5·9	13·9	10·3
20	11 05·0	11 06·8	10 34·7	2·0	1·5	8·0	5·9	14·0	10·4
21	11 05·3	11 07·1	10 34·9	2·1	1·6	8·1	6·0	14·1	10·5
22	11 05·5	11 07·3	10 35·2	2·2	1·6	8·2	6·1	14·2	10·5
23	11 05·8	11 07·6	10 35·4	2·3	1·7	8·3	6·2	14·3	10·6
24	11 06·0	11 07·8	10 35·7	2·4	1·8	8·4	6·2	14·4	10·7
25	11 06·3	11 08·1	10 35·9	2·5	1·9	8·5	6·3	14·5	10·8
26	11 06·5	11 08·3	10 36·1	2·6	1·9	8·6	6·4	14·6	10·8
27	11 06·8	11 08·6	10 36·4	2·7	2·0	8·7	6·5	14·7	10·9
28	11 07·0	11 08·8	10 36·6	2·8	2·1	8·8	6·5	14·8	11·0
29	11 07·3	11 09·1	10 36·9	2·9	2·2	8·9	6·6	14·9	11·1
30	11 07·5	11 09·3	10 37·1	3·0	2·2	9·0	6·7	15·0	11·1
31	11 07·8	11 09·6	10 37·3	3·1	2·3	9·1	6·7	15·1	11·2
32	11 08·0	11 09·8	10 37·6	3·2	2·4	9·2	6·8	15·2	11·3
33	11 08·3	11 10·1	10 37·8	3·3	2·4	9·3	6·9	15·3	11·3
34	11 08·5	11 10·3	10 38·0	3·4	2·5	9·4	7·0	15·4	11·4
35	11 08·8	11 10·6	10 38·3	3·5	2·6	9·5	7·0	15·5	11·5
36	11 09·0	11 10·8	10 38·5	3·6	2·7	9·6	7·1	15·6	11·6
37	11 09·3	11 11·1	10 38·8	3·7	2·7	9·7	7·2	15·7	11·6
38	11 09·5	11 11·3	10 39·0	3·8	2·8	9·8	7·3	15·8	11·7
39	11 09·8	11 11·6	10 39·2	3·9	2·9	9·9	7·3	15·9	11·8
40	11 10·0	11 11·8	10 39·5	4·0	3·0	10·0	7·4	16·0	11·9
41	11 10·3	11 12·1	10 39·7	4·1	3·0	10·1	7·5	16·1	11·9
42	11 10·5	11 12·3	10 40·0	4·2	3·1	10·2	7·6	16·2	12·0
43	11 10·8	11 12·6	10 40·2	4·3	3·2	10·3	7·6	16·3	12·1
44	11 11·0	11 12·8	10 40·4	4·4	3·3	10·4	7·7	16·4	12·2
45	11 11·3	11 13·1	10 40·7	4·5	3·3	10·5	7·8	16·5	12·2
46	11 11·5	11 13·3	10 40·9	4·6	3·4	10·6	7·9	16·6	12·3
47	11 11·8	11 13·6	10 41·1	4·7	3·5	10·7	7·9	16·7	12·4
48	11 12·0	11 13·8	10 41·4	4·8	3·6	10·8	8·0	16·8	12·5
49	11 12·3	11 14·1	10 41·6	4·9	3·6	10·9	8·1	16·9	12·5
50	11 12·5	11 14·3	10 41·9	5·0	3·7	11·0	8·2	17·0	12·6
51	11 12·8	11 14·6	10 42·1	5·1	3·8	11·1	8·2	17·1	12·7
52	11 13·0	11 14·8	10 42·3	5·2	3·9	11·2	8·3	17·2	12·8
53	11 13·3	11 15·1	10 42·6	5·3	3·9	11·3	8·4	17·3	12·8
54	11 13·5	11 15·3	10 42·8	5·4	4·0	11·4	8·5	17·4	12·9
55	11 13·8	11 15·6	10 43·1	5·5	4·1	11·5	8·5	17·5	13·0
56	11 14·0	11 15·8	10 43·3	5·6	4·2	11·6	8·6	17·6	13·1
57	11 14·3	11 16·1	10 43·5	5·7	4·2	11·7	8·7	17·7	13·1
58	11 14·5	11 16·3	10 43·8	5·8	4·3	11·8	8·8	17·8	13·2
59	11 14·8	11 16·6	10 44·0	5·9	4·4	11·9	8·8	17·9	13·3
60	11 15·0	11 16·8	10 44·3	6·0	4·5	12·0	8·9	18·0	13·4

45m	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	11 15·0	11 16·8	10 44·3	0·0	0·0	6·0	4·6	12·0	9·1
01	11 15·3	11 17·1	10 44·5	0·1	0·1	6·1	4·6	12·1	9·2
02	11 15·5	11 17·3	10 44·7	0·2	0·2	6·2	4·7	12·2	9·3
03	11 15·8	11 17·6	10 45·0	0·3	0·2	6·3	4·8	12·3	9·3
04	11 16·0	11 17·9	10 45·2	0·4	0·3	6·4	4·9	12·4	9·4
05	11 16·3	11 18·1	10 45·4	0·5	0·4	6·5	4·9	12·5	9·5
06	11 16·5	11 18·4	10 45·7	0·6	0·5	6·6	5·0	12·6	9·6
07	11 16·8	11 18·6	10 45·9	0·7	0·5	6·7	5·1	12·7	9·6
08	11 17·0	11 18·9	10 46·2	0·8	0·6	6·8	5·2	12·8	9·7
09	11 17·3	11 19·1	10 46·4	0·9	0·7	6·9	5·2	12·9	9·8
10	11 17·5	11 19·4	10 46·6	1·0	0·8	7·0	5·3	13·0	9·9
11	11 17·8	11 19·6	10 46·9	1·1	0·8	7·1	5·4	13·1	9·9
12	11 18·0	11 19·9	10 47·1	1·2	0·9	7·2	5·5	13·2	10·0
13	11 18·3	11 20·1	10 47·4	1·3	1·0	7·3	5·5	13·3	10·1
14	11 18·5	11 20·4	10 47·6	1·4	1·1	7·4	5·6	13·4	10·2
15	11 18·8	11 20·6	10 47·8	1·5	1·1	7·5	5·7	13·5	10·2
16	11 19·0	11 20·9	10 48·1	1·6	1·2	7·6	5·8	13·6	10·3
17	11 19·3	11 21·1	10 48·3	1·7	1·3	7·7	5·8	13·7	10·4
18	11 19·5	11 21·4	10 48·5	1·8	1·4	7·8	5·9	13·8	10·5
19	11 19·8	11 21·6	10 48·8	1·9	1·4	7·9	6·0	13·9	10·5
20	11 20·0	11 21·9	10 49·0	2·0	1·5	8·0	6·1	14·0	10·6
21	11 20·3	11 22·1	10 49·3	2·1	1·6	8·1	6·1	14·1	10·7
22	11 20·5	11 22·4	10 49·5	2·2	1·7	8·2	6·2	14·2	10·8
23	11 20·8	11 22·6	10 49·7	2·3	1·7	8·3	6·3	14·3	10·8
24	11 21·0	11 22·9	10 50·0	2·4	1·8	8·4	6·4	14·4	10·9
25	11 21·3	11 23·1	10 50·2	2·5	1·9	8·5	6·4	14·5	11·0
26	11 21·5	11 23·4	10 50·5	2·6	2·0	8·6	6·5	14·6	11·1
27	11 21·8	11 23·6	10 50·7	2·7	2·0	8·7	6·6	14·7	11·1
28	11 22·0	11 23·9	10 50·9	2·8	2·1	8·8	6·7	14·8	11·2
29	11 22·3	11 24·1	10 51·2	2·9	2·2	8·9	6·7	14·9	11·3
30	11 22·5	11 24·4	10 51·4	3·0	2·3	9·0	6·8	15·0	11·4
31	11 22·8	11 24·6	10 51·6	3·1	2·4	9·1	6·9	15·1	11·5
32	11 23·0	11 24·9	10 51·9	3·2	2·4	9·2	7·0	15·2	11·5
33	11 23·3	11 25·1	10 52·1	3·3	2·5	9·3	7·1	15·3	11·6
34	11 23·5	11 25·4	10 52·4	3·4	2·6	9·4	7·1	15·4	11·7
35	11 23·8	11 25·6	10 52·6	3·5	2·7	9·5	7·2	15·5	11·8
36	11 24·0	11 25·9	10 52·8	3·6	2·7	9·6	7·3	15·6	11·8
37	11 24·3	11 26·1	10 53·1	3·7	2·8	9·7	7·4	15·7	11·9
38	11 24·5	11 26·4	10 53·3	3·8	2·9	9·8	7·4	15·8	12·0
39	11 24·8	11 26·6	10 53·6	3·9	3·0	9·9	7·5	15·9	12·1
40	11 25·0	11 26·9	10 53·8	4·0	3·0	10·0	7·6	16·0	12·1
41	11 25·3	11 27·1	10 54·0	4·1	3·1	10·1	7·7	16·1	12·2
42	11 25·5	11 27·4	10 54·3	4·2	3·2	10·2	7·7	16·2	12·3
43	11 25·8	11 27·6	10 54·5	4·3	3·3	10·3	7·8	16·3	12·4
44	11 26·0	11 27·9	10 54·7	4·4	3·3	10·4	7·9	16·4	12·4
45	11 26·3	11 28·1	10 55·0	4·5	3·4	10·5	8·0	16·5	12·5
46	11 26·5	11 28·4	10 55·2	4·6	3·5	10·6	8·0	16·6	12·6
47	11 26·8	11 28·6	10 55·5	4·7	3·6	10·7	8·1	16·7	12·7
48	11 27·0	11 28·9	10 55·7	4·8	3·6	10·8	8·2	16·8	12·7
49	11 27·3	11 29·1	10 55·9	4·9	3·7	10·9	8·3	16·9	12·8
50	11 27·5	11 29·4	10 56·2	5·0	3·8	11·0	8·3	17·0	12·9
51	11 27·8	11 29·6	10 56·4	5·1	3·9	11·1	8·4	17·1	13·0
52	11 28·0	11 29·9	10 56·7	5·2	3·9	11·2	8·5	17·2	13·0
53	11 28·3	11 30·1	10 56·9	5·3	4·0	11·3	8·6	17·3	13·1
54	11 28·5	11 30·4	10 57·1	5·4	4·1	11·4	8·6	17·4	13·2
55	11 28·8	11 30·6	10 57·4	5·5	4·2	11·5	8·7	17·5	13·3
56	11 29·0	11 30·9	10 57·6	5·6	4·2	11·6	8·8	17·6	13·3
57	11 29·3	11 31·1	10 57·9	5·7	4·3	11·7	8·9	17·7	13·4
58	11 29·5	11 31·4	10 58·1	5·8	4·4	11·8	8·9	17·8	13·5
59	11 29·8	11 31·6	10 58·3	5·9	4·5	11·9	9·0	17·9	13·6
60	11 30·0	11 31·9	10 58·6	6·0	4·6	12·0	9·1	18·0	13·7

m 46	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	11 30·0	11 31·9	10 58·6	0·0	0·0	6·0	4·7	12·0	9·3
01	11 30·3	11 32·1	10 58·8	0·1	0·1	6·1	4·7	12·1	9·4
02	11 30·5	11 32·4	10 59·0	0·2	0·2	6·2	4·8	12·2	9·5
03	11 30·8	11 32·6	10 59·3	0·3	0·2	6·3	4·9	12·3	9·5
04	11 31·0	11 32·9	10 59·5	0·4	0·3	6·4	5·0	12·4	9·6
05	11 31·3	11 33·1	10 59·8	0·5	0·4	6·5	5·0	12·5	9·7
06	11 31·5	11 33·4	11 00·0	0·6	0·5	6·6	5·1	12·6	9·8
07	11 31·8	11 33·6	11 00·2	0·7	0·5	6·7	5·2	12·7	9·8
08	11 32·0	11 33·9	11 00·5	0·8	0·6	6·8	5·3	12·8	9·9
09	11 32·3	11 34·1	11 00·7	0·9	0·7	6·9	5·3	12·9	10·0
10	11 32·5	11 34·4	11 01·0	1·0	0·8	7·0	5·4	13·0	10·1
11	11 32·8	11 34·6	11 01·2	1·1	0·9	7·1	5·5	13·1	10·2
12	11 33·0	11 34·9	11 01·4	1·2	0·9	7·2	5·6	13·2	10·2
13	11 33·3	11 35·1	11 01·7	1·3	1·0	7·3	5·7	13·3	10·3
14	11 33·5	11 35·4	11 01·9	1·4	1·1	7·4	5·7	13·4	10·4
15	11 33·8	11 35·6	11 02·1	1·5	1·2	7·5	5·8	13·5	10·5
16	11 34·0	11 35·9	11 02·4	1·6	1·2	7·6	5·9	13·6	10·5
17	11 34·3	11 36·2	11 02·6	1·7	1·3	7·7	6·0	13·7	10·6
18	11 34·5	11 36·4	11 02·9	1·8	1·4	7·8	6·0	13·8	10·7
19	11 34·8	11 36·7	11 03·1	1·9	1·5	7·9	6·1	13·9	10·8
20	11 35·0	11 36·9	11 03·3	2·0	1·6	8·0	6·2	14·0	10·9
21	11 35·3	11 37·2	11 03·6	2·1	1·6	8·1	6·3	14·1	10·9
22	11 35·5	11 37·4	11 03·8	2·2	1·7	8·2	6·4	14·2	11·0
23	11 35·8	11 37·7	11 04·1	2·3	1·8	8·3	6·4	14·3	11·1
24	11 36·0	11 37·9	11 04·3	2·4	1·9	8·4	6·5	14·4	11·2
25	11 36·3	11 38·2	11 04·5	2·5	1·9	8·5	6·6	14·5	11·2
26	11 36·5	11 38·4	11 04·8	2·6	2·0	8·6	6·7	14·6	11·3
27	11 36·8	11 38·7	11 05·0	2·7	2·1	8·7	6·7	14·7	11·4
28	11 37·0	11 38·9	11 05·2	2·8	2·2	8·8	6·8	14·8	11·5
29	11 37·3	11 39·2	11 05·5	2·9	2·2	8·9	6·9	14·9	11·5
30	11 37·5	11 39·4	11 05·7	3·0	2·3	9·0	7·0	15·0	11·6
31	11 37·8	11 39·7	11 06·0	3·1	2·4	9·1	7·1	15·1	11·7
32	11 38·0	11 39·9	11 06·2	3·2	2·5	9·2	7·1	15·2	11·8
33	11 38·3	11 40·2	11 06·4	3·3	2·6	9·3	7·2	15·3	11·9
34	11 38·5	11 40·4	11 06·7	3·4	2·6	9·4	7·3	15·4	11·9
35	11 38·8	11 40·7	11 06·9	3·5	2·7	9·5	7·4	15·5	12·0
36	11 39·0	11 40·9	11 07·2	3·6	2·8	9·6	7·4	15·6	12·1
37	11 39·3	11 41·2	11 07·4	3·7	2·9	9·7	7·5	15·7	12·2
38	11 39·5	11 41·4	11 07·6	3·8	2·9	9·8	7·6	15·8	12·2
39	11 39·8	11 41·7	11 07·9	3·9	3·0	9·9	7·7	15·9	12·3
40	11 40·0	11 41·9	11 08·1	4·0	3·1	10·0	7·8	16·0	12·4
41	11 40·3	11 42·2	11 08·3	4·1	3·2	10·1	7·8	16·1	12·5
42	11 40·5	11 42·4	11 08·6	4·2	3·3	10·2	7·9	16·2	12·6
43	11 40·8	11 42·7	11 08·8	4·3	3·3	10·3	8·0	16·3	12·6
44	11 41·0	11 42·9	11 09·1	4·4	3·4	10·4	8·1	16·4	12·7
45	11 41·3	11 43·2	11 09·3	4·5	3·5	10·5	8·1	16·5	12·8
46	11 41·5	11 43·4	11 09·5	4·6	3·6	10·6	8·2	16·6	12·9
47	11 41·8	11 43·7	11 09·8	4·7	3·6	10·7	8·3	16·7	12·9
48	11 42·0	11 43·9	11 10·0	4·8	3·7	10·8	8·4	16·8	13·0
49	11 42·3	11 44·2	11 10·3	4·9	3·8	10·9	8·4	16·9	13·1
50	11 42·5	11 44·4	11 10·5	5·0	3·9	11·0	8·5	17·0	13·2
51	11 42·8	11 44·7	11 10·7	5·1	4·0	11·1	8·6	17·1	13·3
52	11 43·0	11 44·9	11 11·0	5·2	4·0	11·2	8·7	17·2	13·3
53	11 43·3	11 45·2	11 11·2	5·3	4·1	11·3	8·8	17·3	13·4
54	11 43·5	11 45·4	11 11·5	5·4	4·2	11·4	8·8	17·4	13·5
55	11 43·8	11 45·7	11 11·7	5·5	4·3	11·5	8·9	17·5	13·6
56	11 44·0	11 45·9	11 11·9	5·6	4·3	11·6	9·0	17·6	13·6
57	11 44·3	11 46·2	11 12·2	5·7	4·4	11·7	9·1	17·7	13·7
58	11 44·5	11 46·4	11 12·4	5·8	4·5	11·8	9·1	17·8	13·8
59	11 44·8	11 46·7	11 12·6	5·9	4·6	11·9	9·2	17·9	13·9
60	11 45·0	11 46·9	11 12·9	6·0	4·7	12·0	9·3	18·0	14·0

m 47	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	11 45·0	11 46·9	11 12·9	0·0	0·0	6·0	4·8	12·0	9·5
01	11 45·3	11 47·2	11 13·1	0·1	0·1	6·1	4·8	12·1	9·6
02	11 45·5	11 47·4	11 13·4	0·2	0·2	6·2	4·9	12·2	9·7
03	11 45·8	11 47·7	11 13·6	0·3	0·2	6·3	5·0	12·3	9·7
04	11 46·0	11 47·9	11 13·8	0·4	0·3	6·4	5·1	12·4	9·8
05	11 46·3	11 48·2	11 14·1	0·5	0·4	6·5	5·1	12·5	9·9
06	11 46·5	11 48·4	11 14·3	0·6	0·5	6·6	5·2	12·6	10·0
07	11 46·8	11 48·7	11 14·6	0·7	0·6	6·7	5·3	12·7	10·1
08	11 47·0	11 48·9	11 14·8	0·8	0·6	6·8	5·4	12·8	10·1
09	11 47·3	11 49·2	11 15·0	0·9	0·7	6·9	5·5	12·9	10·2
10	11 47·5	11 49·4	11 15·3	1·0	0·8	7·0	5·5	13·0	10·3
11	11 47·8	11 49·7	11 15·5	1·1	0·9	7·1	5·6	13·1	10·4
12	11 48·0	11 49·9	11 15·7	1·2	1·0	7·2	5·7	13·2	10·5
13	11 48·3	11 50·2	11 16·0	1·3	1·0	7·3	5·8	13·3	10·5
14	11 48·5	11 50·4	11 16·2	1·4	1·1	7·4	5·9	13·4	10·6
15	11 48·8	11 50·7	11 16·5	1·5	1·2	7·5	5·9	13·5	10·7
16	11 49·0	11 50·9	11 16·7	1·6	1·3	7·6	6·0	13·6	10·8
17	11 49·3	11 51·2	11 16·9	1·7	1·3	7·7	6·1	13·7	10·8
18	11 49·5	11 51·4	11 17·2	1·8	1·4	7·8	6·2	13·8	10·9
19	11 49·8	11 51·7	11 17·4	1·9	1·5	7·9	6·3	13·9	11·0
20	11 50·0	11 51·9	11 17·7	2·0	1·6	8·0	6·3	14·0	11·1
21	11 50·3	11 52·2	11 17·9	2·1	1·7	8·1	6·4	14·1	11·2
22	11 50·5	11 52·4	11 18·1	2·2	1·7	8·2	6·5	14·2	11·2
23	11 50·8	11 52·7	11 18·4	2·3	1·8	8·3	6·6	14·3	11·3
24	11 51·0	11 52·9	11 18·6	2·4	1·9	8·4	6·7	14·4	11·4
25	11 51·3	11 53·2	11 18·8	2·5	2·0	8·5	6·7	14·5	11·5
26	11 51·5	11 53·4	11 19·1	2·6	2·1	8·6	6·8	14·6	11·6
27	11 51·8	11 53·7	11 19·3	2·7	2·1	8·7	6·9	14·7	11·6
28	11 52·0	11 53·9	11 19·6	2·8	2·2	8·8	7·0	14·8	11·7
29	11 52·3	11 54·2	11 19·8	2·9	2·3	8·9	7·0	14·9	11·8
30	11 52·5	11 54·5	11 20·0	3·0	2·4	9·0	7·1	15·0	11·9
31	11 52·8	11 54·7	11 20·3	3·1	2·5	9·1	7·2	15·1	12·0
32	11 53·0	11 55·0	11 20·5	3·2	2·5	9·2	7·3	15·2	12·0
33	11 53·3	11 55·2	11 20·8	3·3	2·6	9·3	7·4	15·3	12·1
34	11 53·5	11 55·5	11 21·0	3·4	2·7	9·4	7·4	15·4	12·2
35	11 53·8	11 55·7	11 21·2	3·5	2·8	9·5	7·5	15·5	12·3
36	11 54·0	11 56·0	11 21·5	3·6	2·9	9·6	7·6	15·6	12·4
37	11 54·3	11 56·2	11 21·7	3·7	2·9	9·7	7·7	15·7	12·4
38	11 54·5	11 56·5	11 22·0	3·8	3·0	9·8	7·8	15·8	12·5
39	11 54·8	11 56·7	11 22·2	3·9	3·1	9·9	7·8	15·9	12·6
40	11 55·0	11 57·0	11 22·4	4·0	3·2	10·0	7·9	16·0	12·7
41	11 55·3	11 57·2	11 22·7	4·1	3·2	10·1	8·0	16·1	12·7
42	11 55·5	11 57·5	11 22·9	4·2	3·3	10·2	8·1	16·2	12·8
43	11 55·8	11 57·7	11 23·1	4·3	3·4	10·3	8·2	16·3	12·9
44	11 56·0	11 58·0	11 23·4	4·4	3·5	10·4	8·2	16·4	13·0
45	11 56·3	11 58·2	11 23·6	4·5	3·6	10·5	8·3	16·5	13·1
46	11 56·5	11 58·5	11 23·9	4·6	3·6	10·6	8·4	16·6	13·1
47	11 56·8	11 58·7	11 24·1	4·7	3·7	10·7	8·5	16·7	13·2
48	11 57·0	11 59·0	11 24·3	4·8	3·8	10·8	8·6	16·8	13·3
49	11 57·3	11 59·2	11 24·6	4·9	3·9	10·9	8·6	16·9	13·4
50	11 57·5	11 59·5	11 24·8	5·0	4·0	11·0	8·7	17·0	13·5
51	11 57·8	11 59·7	11 25·1	5·1	4·0	11·1	8·8	17·1	13·5
52	11 58·0	12 00·0	11 25·3	5·2	4·1	11·2	8·9	17·2	13·6
53	11 58·3	12 00·2	11 25·5	5·3	4·2	11·3	8·9	17·3	13·7
54	11 58·5	12 00·5	11 25·8	5·4	4·3	11·4	9·0	17·4	13·8
55	11 58·8	12 00·7	11 26·0	5·5	4·4	11·5	9·1	17·5	13·9
56	11 59·0	12 01·0	11 26·2	5·6	4·4	11·6	9·2	17·6	13·9
57	11 59·3	12 01·2	11 26·5	5·7	4·5	11·7	9·3	17·7	14·0
58	11 59·5	12 01·5	11 26·7	5·8	4·6	11·8	9·3	17·8	14·1
59	11 59·8	12 01·7	11 27·0	5·9	4·7	11·9	9·4	17·9	14·2
60	12 00·0	12 02·0	11 27·2	6·0	4·8	12·0	9·5	18·0	14·3

m 48	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	° ′	° ′	° ′	′	′	′	′	′	′
00	12 00·0	12 02·0	11 27·2	0·0	0·0	6·0	4·9	12·0	9·7
01	12 00·3	12 02·2	11 27·4	0·1	0·1	6·1	4·9	12·1	9·8
02	12 00·5	12 02·5	11 27·7	0·2	0·2	6·2	5·0	12·2	9·9
03	12 00·8	12 02·7	11 27·9	0·3	0·2	6·3	5·1	12·3	9·9
04	12 01·0	12 03·0	11 28·2	0·4	0·3	6·4	5·2	12·4	10·0
05	12 01·3	12 03·2	11 28·4	0·5	0·4	6·5	5·3	12·5	10·1
06	12 01·5	12 03·5	11 28·6	0·6	0·5	6·6	5·3	12·6	10·2
07	12 01·8	12 03·7	11 28·9	0·7	0·6	6·7	5·4	12·7	10·3
08	12 02·0	12 04·0	11 29·1	0·8	0·6	6·8	5·5	12·8	10·3
09	12 02·3	12 04·2	11 29·3	0·9	0·7	6·9	5·6	12·9	10·4
10	12 02·5	12 04·5	11 29·6	1·0	0·8	7·0	5·7	13·0	10·5
11	12 02·8	12 04·7	11 29·8	1·1	0·9	7·1	5·7	13·1	10·6
12	12 03·0	12 05·0	11 30·1	1·2	1·0	7·2	5·8	13·2	10·7
13	12 03·3	12 05·2	11 30·3	1·3	1·1	7·3	5·9	13·3	10·8
14	12 03·5	12 05·5	11 30·5	1·4	1·1	7·4	6·0	13·4	10·8
15	12 03·8	12 05·7	11 30·8	1·5	1·2	7·5	6·1	13·5	10·9
16	12 04·0	12 06·0	11 31·0	1·6	1·3	7·6	6·1	13·6	11·0
17	12 04·3	12 06·2	11 31·3	1·7	1·4	7·7	6·2	13·7	11·1
18	12 04·5	12 06·5	11 31·5	1·8	1·5	7·8	6·3	13·8	11·2
19	12 04·8	12 06·7	11 31·7	1·9	1·5	7·9	6·4	13·9	11·2
20	12 05·0	12 07·0	11 32·0	2·0	1·6	8·0	6·5	14·0	11·3
21	12 05·3	12 07·2	11 32·2	2·1	1·7	8·1	6·5	14·1	11·4
22	12 05·5	12 07·5	11 32·4	2·2	1·8	8·2	6·6	14·2	11·5
23	12 05·8	12 07·7	11 32·7	2·3	1·9	8·3	6·7	14·3	11·6
24	12 06·0	12 08·0	11 32·9	2·4	1·9	8·4	6·8	14·4	11·6
25	12 06·3	12 08·2	11 33·2	2·5	2·0	8·5	6·9	14·5	11·7
26	12 06·5	12 08·5	11 33·4	2·6	2·1	8·6	7·0	14·6	11·8
27	12 06·8	12 08·7	11 33·6	2·7	2·2	8·7	7·0	14·7	11·9
28	12 07·0	12 09·0	11 33·9	2·8	2·3	8·8	7·1	14·8	12·0
29	12 07·3	12 09·2	11 34·1	2·9	2·3	8·9	7·2	14·9	12·0
30	12 07·5	12 09·5	11 34·4	3·0	2·4	9·0	7·3	15·0	12·1
31	12 07·8	12 09·7	11 34·6	3·1	2·5	9·1	7·4	15·1	12·2
32	12 08·0	12 10·0	11 34·8	3·2	2·6	9·2	7·4	15·2	12·3
33	12 08·3	12 10·2	11 35·1	3·3	2·7	9·3	7·5	15·3	12·4
34	12 08·5	12 10·5	11 35·3	3·4	2·7	9·4	7·6	15·4	12·4
35	12 08·8	12 10·7	11 35·6	3·5	2·8	9·5	7·7	15·5	12·5
36	12 09·0	12 11·0	11 35·8	3·6	2·9	9·6	7·8	15·6	12·6
37	12 09·3	12 11·2	11 36·0	3·7	3·0	9·7	7·8	15·7	12·7
38	12 09·5	12 11·5	11 36·3	3·8	3·1	9·8	7·9	15·8	12·8
39	12 09·8	12 11·7	11 36·5	3·9	3·2	9·9	8·0	15·9	12·9
40	12 10·0	12 12·0	11 36·7	4·0	3·2	10·0	8·1	16·0	12·9
41	12 10·3	12 12·2	11 37·0	4·1	3·3	10·1	8·2	16·1	13·0
42	12 10·5	12 12·5	11 37·2	4·2	3·4	10·2	8·2	16·2	13·1
43	12 10·8	12 12·8	11 37·5	4·3	3·5	10·3	8·3	16·3	13·2
44	12 11·0	12 13·0	11 37·7	4·4	3·6	10·4	8·4	16·4	13·3
45	12 11·3	12 13·3	11 37·9	4·5	3·6	10·5	8·5	16·5	13·3
46	12 11·5	12 13·5	11 38·2	4·6	3·7	10·6	8·6	16·6	13·4
47	12 11·8	12 13·8	11 38·4	4·7	3·8	10·7	8·6	16·7	13·5
48	12 12·0	12 14·0	11 38·7	4·8	3·9	10·8	8·7	16·8	13·6
49	12 12·3	12 14·3	11 38·9	4·9	4·0	10·9	8·8	16·9	13·7
50	12 12·5	12 14·5	11 39·1	5·0	4·0	11·0	8·9	17·0	13·7
51	12 12·8	12 14·8	11 39·4	5·1	4·1	11·1	9·0	17·1	13·8
52	12 13·0	12 15·0	11 39·6	5·2	4·2	11·2	9·1	17·2	13·9
53	12 13·3	12 15·3	11 39·8	5·3	4·3	11·3	9·1	17·3	14·0
54	12 13·5	12 15·5	11 40·1	5·4	4·4	11·4	9·2	17·4	14·1
55	12 13·8	12 15·8	11 40·3	5·5	4·4	11·5	9·3	17·5	14·1
56	12 14·0	12 16·0	11 40·6	5·6	4·5	11·6	9·4	17·6	14·2
57	12 14·3	12 16·3	11 40·8	5·7	4·6	11·7	9·5	17·7	14·3
58	12 14·5	12 16·5	11 41·0	5·8	4·7	11·8	9·5	17·8	14·4
59	12 14·8	12 16·8	11 41·3	5·9	4·8	11·9	9·6	17·9	14·5
60	12 15·0	12 17·0	11 41·5	6·0	4·9	12·0	9·7	18·0	14·6

m 49	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	° ′	° ′	° ′	′	′	′	′	′	′
00	12 15·0	12 17·0	11 41·5	0·0	0·0	6·0	5·0	12·0	9·9
01	12 15·3	12 17·3	11 41·8	0·1	0·1	6·1	5·0	12·1	10·0
02	12 15·5	12 17·5	11 42·0	0·2	0·2	6·2	5·1	12·2	10·1
03	12 15·8	12 17·8	11 42·2	0·3	0·2	6·3	5·2	12·3	10·1
04	12 16·0	12 18·0	11 42·5	0·4	0·3	6·4	5·3	12·4	10·2
05	12 16·3	12 18·3	11 42·7	0·5	0·4	6·5	5·4	12·5	10·3
06	12 16·5	12 18·5	11 42·9	0·6	0·5	6·6	5·4	12·6	10·4
07	12 16·8	12 18·8	11 43·2	0·7	0·6	6·7	5·5	12·7	10·5
08	12 17·0	12 19·0	11 43·4	0·8	0·7	6·8	5·6	12·8	10·6
09	12 17·3	12 19·3	11 43·7	0·9	0·7	6·9	5·7	12·9	10·6
10	12 17·5	12 19·5	11 43·9	1·0	0·8	7·0	5·8	13·0	10·7
11	12 17·8	12 19·8	11 44·1	1·1	0·9	7·1	5·9	13·1	10·8
12	12 18·0	12 20·0	11 44·4	1·2	1·0	7·2	5·9	13·2	10·9
13	12 18·3	12 20·3	11 44·6	1·3	1·1	7·3	6·0	13·3	11·0
14	12 18·5	12 20·5	11 44·9	1·4	1·2	7·4	6·1	13·4	11·1
15	12 18·8	12 20·8	11 45·1	1·5	1·2	7·5	6·2	13·5	11·1
16	12 19·0	12 21·0	11 45·3	1·6	1·3	7·6	6·3	13·6	11·2
17	12 19·3	12 21·3	11 45·6	1·7	1·4	7·7	6·4	13·7	11·3
18	12 19·5	12 21·5	11 45·8	1·8	1·5	7·8	6·4	13·8	11·4
19	12 19·8	12 21·8	11 46·1	1·9	1·6	7·9	6·5	13·9	11·5
20	12 20·0	12 22·0	11 46·3	2·0	1·7	8·0	6·6	14·0	11·6
21	12 20·3	12 22·3	11 46·5	2·1	1·7	8·1	6·7	14·1	11·6
22	12 20·5	12 22·5	11 46·8	2·2	1·8	8·2	6·8	14·2	11·7
23	12 20·8	12 22·8	11 47·0	2·3	1·9	8·3	6·8	14·3	11·8
24	12 21·0	12 23·0	11 47·2	2·4	2·0	8·4	6·9	14·4	11·9
25	12 21·3	12 23·3	11 47·5	2·5	2·1	8·5	7·0	14·5	12·0
26	12 21·5	12 23·5	11 47·7	2·6	2·1	8·6	7·1	14·6	12·0
27	12 21·8	12 23·8	11 48·0	2·7	2·2	8·7	7·2	14·7	12·1
28	12 22·0	12 24·0	11 48·2	2·8	2·3	8·8	7·3	14·8	12·2
29	12 22·3	12 24·3	11 48·4	2·9	2·4	8·9	7·3	14·9	12·3
30	12 22·5	12 24·5	11 48·7	3·0	2·5	9·0	7·4	15·0	12·4
31	12 22·8	12 24·8	11 48·9	3·1	2·6	9·1	7·5	15·1	12·5
32	12 23·0	12 25·0	11 49·2	3·2	2·6	9·2	7·6	15·2	12·5
33	12 23·3	12 25·3	11 49·4	3·3	2·7	9·3	7·7	15·3	12·6
34	12 23·5	12 25·5	11 49·6	3·4	2·8	9·4	7·8	15·4	12·7
35	12 23·8	12 25·8	11 49·9	3·5	2·9	9·5	7·8	15·5	12·8
36	12 24·0	12 26·0	11 50·1	3·6	3·0	9·6	7·9	15·6	12·9
37	12 24·3	12 26·3	11 50·3	3·7	3·1	9·7	8·0	15·7	13·0
38	12 24·5	12 26·5	11 50·6	3·8	3·1	9·8	8·1	15·8	13·0
39	12 24·8	12 26·8	11 50·8	3·9	3·2	9·9	8·2	15·9	13·1
40	12 25·0	12 27·0	11 51·1	4·0	3·3	10·0	8·3	16·0	13·2
41	12 25·3	12 27·3	11 51·3	4·1	3·4	10·1	8·3	16·1	13·3
42	12 25·5	12 27·5	11 51·5	4·2	3·5	10·2	8·4	16·2	13·4
43	12 25·8	12 27·8	11 51·8	4·3	3·5	10·3	8·5	16·3	13·4
44	12 26·0	12 28·0	11 52·0	4·4	3·6	10·4	8·6	16·4	13·5
45	12 26·3	12 28·3	11 52·3	4·5	3·7	10·5	8·7	16·5	13·6
46	12 26·5	12 28·5	11 52·5	4·6	3·8	10·6	8·7	16·6	13·7
47	12 26·8	12 28·8	11 52·7	4·7	3·9	10·7	8·8	16·7	13·8
48	12 27·0	12 29·0	11 53·0	4·8	4·0	10·8	8·9	16·8	13·9
49	12 27·3	12 29·3	11 53·2	4·9	4·0	10·9	9·0	16·9	13·9
50	12 27·5	12 29·5	11 53·4	5·0	4·1	11·0	9·1	17·0	14·0
51	12 27·8	12 29·8	11 53·7	5·1	4·2	11·1	9·2	17·1	14·1
52	12 28·0	12 30·0	11 53·9	5·2	4·3	11·2	9·2	17·2	14·2
53	12 28·3	12 30·3	11 54·2	5·3	4·4	11·3	9·3	17·3	14·3
54	12 28·5	12 30·5	11 54·4	5·4	4·5	11·4	9·4	17·4	14·4
55	12 28·8	12 30·8	11 54·6	5·5	4·5	11·5	9·5	17·5	14·4
56	12 29·0	12 31·1	11 54·9	5·6	4·6	11·6	9·6	17·6	14·5
57	12 29·3	12 31·3	11 55·1	5·7	4·7	11·7	9·7	17·7	14·6
58	12 29·5	12 31·6	11 55·4	5·8	4·8	11·8	9·7	17·8	14·7
59	12 29·8	12 31·8	11 55·6	5·9	4·9	11·9	9·8	17·9	14·8
60	12 30·0	12 32·1	11 55·8	6·0	5·0	12·0	9·9	18·0	14·9

50m	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	12 30·0	12 32·1	11 55·8	0·0	0·0	6·0	5·1	12·0	10·1
01	12 30·3	12 32·3	11 56·1	0·1	0·1	6·1	5·1	12·1	10·2
02	12 30·5	12 32·6	11 56·3	0·2	0·2	6·2	5·2	12·2	10·3
03	12 30·8	12 32·8	11 56·5	0·3	0·3	6·3	5·3	12·3	10·4
04	12 31·0	12 33·1	11 56·8	0·4	0·3	6·4	5·4	12·4	10·4
05	12 31·3	12 33·3	11 57·0	0·5	0·4	6·5	5·5	12·5	10·5
06	12 31·5	12 33·6	11 57·3	0·6	0·5	6·6	5·6	12·6	10·6
07	12 31·8	12 33·8	11 57·5	0·7	0·6	6·7	5·6	12·7	10·7
08	12 32·0	12 34·1	11 57·7	0·8	0·7	6·8	5·7	12·8	10·8
09	12 32·3	12 34·3	11 58·0	0·9	0·8	6·9	5·8	12·9	10·9
10	12 32·5	12 34·6	11 58·2	1·0	0·8	7·0	5·9	13·0	10·9
11	12 32·8	12 34·8	11 58·5	1·1	0·9	7·1	6·0	13·1	11·0
12	12 33·0	12 35·1	11 58·7	1·2	1·0	7·2	6·1	13·2	11·1
13	12 33·3	12 35·3	11 58·9	1·3	1·1	7·3	6·1	13·3	11·2
14	12 33·5	12 35·6	11 59·2	1·4	1·2	7·4	6·2	13·4	11·3
15	12 33·8	12 35·8	11 59·4	1·5	1·3	7·5	6·3	13·5	11·4
16	12 34·0	12 36·1	11 59·7	1·6	1·3	7·6	6·4	13·6	11·4
17	12 34·3	12 36·3	11 59·9	1·7	1·4	7·7	6·5	13·7	11·5
18	12 34·5	12 36·6	12 00·1	1·8	1·5	7·8	6·6	13·8	11·6
19	12 34·8	12 36·8	12 00·4	1·9	1·6	7·9	6·6	13·9	11·7
20	12 35·0	12 37·1	12 00·6	2·0	1·7	8·0	6·7	14·0	11·8
21	12 35·3	12 37·3	12 00·8	2·1	1·8	8·1	6·8	14·1	11·9
22	12 35·5	12 37·6	12 01·1	2·2	1·9	8·2	6·9	14·2	12·0
23	12 35·8	12 37·8	12 01·3	2·3	1·9	8·3	7·0	14·3	12·0
24	12 36·0	12 38·1	12 01·6	2·4	2·0	8·4	7·1	14·4	12·1
25	12 36·3	12 38·3	12 01·8	2·5	2·1	8·5	7·2	14·5	12·2
26	12 36·5	12 38·6	12 02·0	2·6	2·2	8·6	7·2	14·6	12·3
27	12 36·8	12 38·8	12 02·3	2·7	2·3	8·7	7·3	14·7	12·4
28	12 37·0	12 39·1	12 02·5	2·8	2·4	8·8	7·4	14·8	12·5
29	12 37·3	12 39·3	12 02·8	2·9	2·4	8·9	7·5	14·9	12·5
30	12 37·5	12 39·6	12 03·0	3·0	2·5	9·0	7·6	15·0	12·6
31	12 37·8	12 39·8	12 03·2	3·1	2·6	9·1	7·7	15·1	12·7
32	12 38·0	12 40·1	12 03·5	3·2	2·7	9·2	7·7	15·2	12·8
33	12 38·3	12 40·3	12 03·7	3·3	2·8	9·3	7·8	15·3	12·9
34	12 38·5	12 40·6	12 03·9	3·4	2·9	9·4	7·9	15·4	13·0
35	12 38·8	12 40·8	12 04·2	3·5	2·9	9·5	8·0	15·5	13·0
36	12 39·0	12 41·1	12 04·4	3·6	3·0	9·6	8·1	15·6	13·1
37	12 39·3	12 41·3	12 04·7	3·7	3·1	9·7	8·2	15·7	13·2
38	12 39·5	12 41·6	12 04·9	3·8	3·2	9·8	8·2	15·8	13·3
39	12 39·8	12 41·8	12 05·1	3·9	3·3	9·9	8·3	15·9	13·4
40	12 40·0	12 42·1	12 05·4	4·0	3·4	10·0	8·4	16·0	13·5
41	12 40·3	12 42·3	12 05·6	4·1	3·5	10·1	8·5	16·1	13·6
42	12 40·5	12 42·6	12 05·9	4·2	3·5	10·2	8·6	16·2	13·6
43	12 40·8	12 42·8	12 06·1	4·3	3·6	10·3	8·7	16·3	13·7
44	12 41·0	12 43·1	12 06·3	4·4	3·7	10·4	8·8	16·4	13·8
45	12 41·3	12 43·3	12 06·6	4·5	3·8	10·5	8·8	16·5	13·9
46	12 41·5	12 43·6	12 06·8	4·6	3·9	10·6	8·9	16·6	14·0
47	12 41·8	12 43·8	12 07·0	4·7	4·0	10·7	9·0	16·7	14·1
48	12 42·0	12 44·1	12 07·3	4·8	4·0	10·8	9·1	16·8	14·1
49	12 42·3	12 44·3	12 07·5	4·9	4·1	10·9	9·2	16·9	14·2
50	12 42·5	12 44·6	12 07·8	5·0	4·2	11·0	9·3	17·0	14·3
51	12 42·8	12 44·8	12 08·0	5·1	4·3	11·1	9·3	17·1	14·4
52	12 43·0	12 45·1	12 08·2	5·2	4·4	11·2	9·4	17·2	14·5
53	12 43·3	12 45·3	12 08·5	5·3	4·5	11·3	9·5	17·3	14·6
54	12 43·5	12 45·6	12 08·7	5·4	4·5	11·4	9·6	17·4	14·6
55	12 43·8	12 45·8	12 09·0	5·5	4·6	11·5	9·7	17·5	14·7
56	12 44·0	12 46·1	12 09·2	5·6	4·7	11·6	9·8	17·6	14·8
57	12 44·3	12 46·3	12 09·4	5·7	4·8	11·7	9·8	17·7	14·9
58	12 44·5	12 46·6	12 09·7	5·8	4·9	11·8	9·9	17·8	15·0
59	12 44·8	12 46·8	12 09·9	5·9	5·0	11·9	10·0	17·9	15·1
60	12 45·0	12 47·1	12 10·2	6·0	5·1	12·0	10·1	18·0	15·2

51m	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	12 45·0	12 47·1	12 10·2	0·0	0·0	6·0	5·2	12·0	10·3
01	12 45·3	12 47·3	12 10·4	0·1	0·1	6·1	5·2	12·1	10·4
02	12 45·5	12 47·6	12 10·6	0·2	0·2	6·2	5·3	12·2	10·5
03	12 45·8	12 47·8	12 10·9	0·3	0·3	6·3	5·4	12·3	10·6
04	12 46·0	12 48·1	12 11·1	0·4	0·3	6·4	5·5	12·4	10·6
05	12 46·3	12 48·3	12 11·3	0·5	0·4	6·5	5·6	12·5	10·7
06	12 46·5	12 48·6	12 11·6	0·6	0·5	6·6	5·7	12·6	10·8
07	12 46·8	12 48·8	12 11·8	0·7	0·6	6·7	5·8	12·7	10·9
08	12 47·0	12 49·1	12 12·1	0·8	0·7	6·8	5·8	12·8	11·0
09	12 47·3	12 49·4	12 12·3	0·9	0·8	6·9	5·9	12·9	11·1
10	12 47·5	12 49·6	12 12·5	1·0	0·9	7·0	6·0	13·0	11·2
11	12 47·8	12 49·9	12 12·8	1·1	0·9	7·1	6·1	13·1	11·2
12	12 48·0	12 50·1	12 13·0	1·2	1·0	7·2	6·2	13·2	11·3
13	12 48·3	12 50·4	12 13·3	1·3	1·1	7·3	6·3	13·3	11·4
14	12 48·5	12 50·6	12 13·5	1·4	1·2	7·4	6·4	13·4	11·5
15	12 48·8	12 50·9	12 13·7	1·5	1·3	7·5	6·4	13·5	11·6
16	12 49·0	12 51·1	12 14·0	1·6	1·4	7·6	6·5	13·6	11·7
17	12 49·3	12 51·4	12 14·2	1·7	1·5	7·7	6·6	13·7	11·8
18	12 49·5	12 51·6	12 14·4	1·8	1·5	7·8	6·7	13·8	11·8
19	12 49·8	12 51·9	12 14·7	1·9	1·6	7·9	6·8	13·9	11·9
20	12 50·0	12 52·1	12 14·9	2·0	1·7	8·0	6·9	14·0	12·0
21	12 50·3	12 52·4	12 15·2	2·1	1·8	8·1	7·0	14·1	12·1
22	12 50·5	12 52·6	12 15·4	2·2	1·9	8·2	7·0	14·2	12·2
23	12 50·8	12 52·9	12 15·6	2·3	2·0	8·3	7·1	14·3	12·3
24	12 51·0	12 53·1	12 15·9	2·4	2·1	8·4	7·2	14·4	12·4
25	12 51·3	12 53·4	12 16·1	2·5	2·1	8·5	7·3	14·5	12·4
26	12 51·5	12 53·6	12 16·4	2·6	2·2	8·6	7·4	14·6	12·5
27	12 51·8	12 53·9	12 16·6	2·7	2·3	8·7	7·5	14·7	12·6
28	12 52·0	12 54·1	12 16·8	2·8	2·4	8·8	7·6	14·8	12·7
29	12 52·3	12 54·4	12 17·1	2·9	2·5	8·9	7·6	14·9	12·8
30	12 52·5	12 54·6	12 17·3	3·0	2·6	9·0	7·7	15·0	12·9
31	12 52·8	12 54·9	12 17·5	3·1	2·7	9·1	7·8	15·1	13·0
32	12 53·0	12 55·1	12 17·8	3·2	2·7	9·2	7·9	15·2	13·0
33	12 53·3	12 55·4	12 18·0	3·3	2·8	9·3	8·0	15·3	13·1
34	12 53·5	12 55·6	12 18·3	3·4	2·9	9·4	8·1	15·4	13·2
35	12 53·8	12 55·9	12 18·5	3·5	3·0	9·5	8·2	15·5	13·3
36	12 54·0	12 56·1	12 18·7	3·6	3·1	9·6	8·2	15·6	13·4
37	12 54·3	12 56·4	12 19·0	3·7	3·2	9·7	8·3	15·7	13·5
38	12 54·5	12 56·6	12 19·2	3·8	3·3	9·8	8·4	15·8	13·6
39	12 54·8	12 56·9	12 19·5	3·9	3·3	9·9	8·5	15·9	13·6
40	12 55·0	12 57·1	12 19·7	4·0	3·4	10·0	8·6	16·0	13·7
41	12 55·3	12 57·4	12 19·9	4·1	3·5	10·1	8·7	16·1	13·8
42	12 55·5	12 57·6	12 20·2	4·2	3·6	10·2	8·8	16·2	13·9
43	12 55·8	12 57·9	12 20·4	4·3	3·7	10·3	8·8	16·3	14·0
44	12 56·0	12 58·1	12 20·6	4·4	3·8	10·4	8·9	16·4	14·1
45	12 56·3	12 58·4	12 20·9	4·5	3·9	10·5	9·0	16·5	14·2
46	12 56·5	12 58·6	12 21·1	4·6	3·9	10·6	9·1	16·6	14·2
47	12 56·8	12 58·9	12 21·4	4·7	4·0	10·7	9·2	16·7	14·3
48	12 57·0	12 59·1	12 21·6	4·8	4·1	10·8	9·3	16·8	14·4
49	12 57·3	12 59·4	12 21·8	4·9	4·2	10·9	9·4	16·9	14·5
50	12 57·5	12 59·6	12 22·1	5·0	4·3	11·0	9·4	17·0	14·6
51	12 57·8	12 59·9	12 22·3	5·1	4·4	11·1	9·5	17·1	14·7
52	12 58·0	13 00·1	12 22·6	5·2	4·5	11·2	9·6	17·2	14·8
53	12 58·3	13 00·4	12 22·8	5·3	4·5	11·3	9·7	17·3	14·8
54	12 58·5	13 00·6	12 23·0	5·4	4·6	11·4	9·8	17·4	14·9
55	12 58·8	13 00·9	12 23·3	5·5	4·7	11·5	9·9	17·5	15·0
56	12 59·0	13 01·1	12 23·5	5·6	4·8	11·6	10·0	17·6	15·1
57	12 59·3	13 01·4	12 23·8	5·7	4·9	11·7	10·0	17·7	15·2
58	12 59·5	13 01·6	12 24·0	5·8	5·0	11·8	10·1	17·8	15·3
59	12 59·8	13 01·9	12 24·2	5·9	5·1	11·9	10·2	17·9	15·4
60	13 00·0	13 02·1	12 24·5	6·0	5·2	12·0	10·3	18·0	15·5

m 52	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	13 00·0	13 02·1	12 24·5	0·0	0·0	6·0	5·3	12·0	10·5
01	13 00·3	13 02·4	12 24·7	0·1	0·1	6·1	5·3	12·1	10·6
02	13 00·5	13 02·6	12 24·9	0·2	0·2	6·2	5·4	12·2	10·7
03	13 00·8	13 02·9	12 25·2	0·3	0·3	6·3	5·5	12·3	10·8
04	13 01·0	13 03·1	12 25·4	0·4	0·4	6·4	5·6	12·4	10·9
05	13 01·3	13 03·4	12 25·7	0·5	0·4	6·5	5·7	12·5	10·9
06	13 01·5	13 03·6	12 25·9	0·6	0·5	6·6	5·8	12·6	11·0
07	13 01·8	13 03·9	12 26·1	0·7	0·6	6·7	5·9	12·7	11·1
08	13 02·0	13 04·1	12 26·4	0·8	0·7	6·8	6·0	12·8	11·2
09	13 02·3	13 04·4	12 26·6	0·9	0·8	6·9	6·0	12·9	11·3
10	13 02·5	13 04·6	12 26·9	1·0	0·9	7·0	6·1	13·0	11·4
11	13 02·8	13 04·9	12 27·1	1·1	1·0	7·1	6·2	13·1	11·5
12	13 03·0	13 05·1	12 27·3	1·2	1·1	7·2	6·3	13·2	11·6
13	13 03·3	13 05·4	12 27·6	1·3	1·1	7·3	6·4	13·3	11·6
14	13 03·5	13 05·6	12 27·8	1·4	1·2	7·4	6·5	13·4	11·7
15	13 03·8	13 05·9	12 28·0	1·5	1·3	7·5	6·6	13·5	11·8
16	13 04·0	13 06·1	12 28·3	1·6	1·4	7·6	6·7	13·6	11·9
17	13 04·3	13 06·4	12 28·5	1·7	1·5	7·7	6·7	13·7	12·0
18	13 04·5	13 06·6	12 28·8	1·8	1·6	7·8	6·8	13·8	12·1
19	13 04·8	13 06·9	12 29·0	1·9	1·7	7·9	6·9	13·9	12·2
20	13 05·0	13 07·1	12 29·2	2·0	1·8	8·0	7·0	14·0	12·3
21	13 05·3	13 07·4	12 29·5	2·1	1·8	8·1	7·1	14·1	12·3
22	13 05·5	13 07·7	12 29·7	2·2	1·9	8·2	7·2	14·2	12·4
23	13 05·8	13 07·9	12 30·0	2·3	2·0	8·3	7·3	14·3	12·5
24	13 06·0	13 08·2	12 30·2	2·4	2·1	8·4	7·4	14·4	12·6
25	13 06·3	13 08·4	12 30·4	2·5	2·2	8·5	7·4	14·5	12·7
26	13 06·5	13 08·7	12 30·7	2·6	2·3	8·6	7·5	14·6	12·8
27	13 06·8	13 08·9	12 30·9	2·7	2·4	8·7	7·6	14·7	12·9
28	13 07·0	13 09·2	12 31·1	2·8	2·5	8·8	7·7	14·8	13·0
29	13 07·3	13 09·4	12 31·4	2·9	2·5	8·9	7·8	14·9	13·0
30	13 07·5	13 09·7	12 31·6	3·0	2·6	9·0	7·9	15·0	13·1
31	13 07·8	13 09·9	12 31·9	3·1	2·7	9·1	8·0	15·1	13·2
32	13 08·0	13 10·2	12 32·1	3·2	2·8	9·2	8·0	15·2	13·3
33	13 08·3	13 10·4	12 32·3	3·3	2·9	9·3	8·1	15·3	13·4
34	13 08·5	13 10·7	12 32·6	3·4	3·0	9·4	8·2	15·4	13·5
35	13 08·8	13 10·9	12 32·8	3·5	3·1	9·5	8·3	15·5	13·6
36	13 09·0	13 11·2	12 33·1	3·6	3·2	9·6	8·4	15·6	13·7
37	13 09·3	13 11·4	12 33·3	3·7	3·2	9·7	8·5	15·7	13·7
38	13 09·5	13 11·7	12 33·5	3·8	3·3	9·8	8·6	15·8	13·8
39	13 09·8	13 11·9	12 33·8	3·9	3·4	9·9	8·7	15·9	13·9
40	13 10·0	13 12·2	12 34·0	4·0	3·5	10·0	8·8	16·0	14·0
41	13 10·3	13 12·4	12 34·2	4·1	3·6	10·1	8·8	16·1	14·1
42	13 10·5	13 12·7	12 34·5	4·2	3·7	10·2	8·9	16·2	14·2
43	13 10·8	13 12·9	12 34·7	4·3	3·8	10·3	9·0	16·3	14·3
44	13 11·0	13 13·2	12 35·0	4·4	3·9	10·4	9·1	16·4	14·3
45	13 11·3	13 13·4	12 35·2	4·5	3·9	10·5	9·2	16·5	14·4
46	13 11·5	13 13·7	12 35·4	4·6	4·0	10·6	9·3	16·6	14·5
47	13 11·8	13 13·9	12 35·7	4·7	4·1	10·7	9·4	16·7	14·6
48	13 12·0	13 14·2	12 35·9	4·8	4·2	10·8	9·5	16·8	14·7
49	13 12·3	13 14·4	12 36·2	4·9	4·3	10·9	9·5	16·9	14·8
50	13 12·5	13 14·7	12 36·4	5·0	4·4	11·0	9·6	17·0	14·9
51	13 12·8	13 14·9	12 36·6	5·1	4·5	11·1	9·7	17·1	15·0
52	13 13·0	13 15·2	12 36·9	5·2	4·6	11·2	9·8	17·2	15·1
53	13 13·3	13 15·4	12 37·1	5·3	4·6	11·3	9·9	17·3	15·1
54	13 13·5	13 15·7	12 37·4	5·4	4·7	11·4	10·0	17·4	15·2
55	13 13·8	13 15·9	12 37·6	5·5	4·8	11·5	10·1	17·5	15·3
56	13 14·0	13 16·2	12 37·8	5·6	4·9	11·6	10·2	17·6	15·4
57	13 14·3	13 16·4	12 38·1	5·7	5·0	11·7	10·2	17·7	15·5
58	13 14·5	13 16·7	12 38·3	5·8	5·1	11·8	10·3	17·8	15·6
59	13 14·8	13 16·9	12 38·5	5·9	5·2	11·9	10·4	17·9	15·7
60	13 15·0	13 17·2	12 38·8	6·0	5·3	12·0	10·5	18·0	15·8

m 53	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	13 15·0	13 17·2	12 38·8	0·0	0·0	6·0	5·4	12·0	10·7
01	13 15·3	13 17·4	12 39·0	0·1	0·1	6·1	5·4	12·1	10·8
02	13 15·5	13 17·7	12 39·3	0·2	0·2	6·2	5·5	12·2	10·9
03	13 15·8	13 17·9	12 39·5	0·3	0·3	6·3	5·6	12·3	11·0
04	13 16·0	13 18·2	12 39·7	0·4	0·4	6·4	5·7	12·4	11·1
05	13 16·3	13 18·4	12 40·0	0·5	0·4	6·5	5·8	12·5	11·1
06	13 16·5	13 18·7	12 40·2	0·6	0·5	6·6	5·9	12·6	11·2
07	13 16·8	13 18·9	12 40·5	0·7	0·6	6·7	6·0	12·7	11·3
08	13 17·0	13 19·2	12 40·7	0·8	0·7	6·8	6·1	12·8	11·4
09	13 17·3	13 19·4	12 40·9	0·9	0·8	6·9	6·2	12·9	11·5
10	13 17·5	13 19·7	12 41·2	1·0	0·9	7·0	6·2	13·0	11·6
11	13 17·8	13 19·9	12 41·4	1·1	1·0	7·1	6·3	13·1	11·7
12	13 18·0	13 20·2	12 41·6	1·2	1·1	7·2	6·4	13·2	11·8
13	13 18·3	13 20·4	12 41·9	1·3	1·2	7·3	6·5	13·3	11·9
14	13 18·5	13 20·7	12 42·1	1·4	1·2	7·4	6·6	13·4	11·9
15	13 18·8	13 20·9	12 42·4	1·5	1·3	7·5	6·7	13·5	12·0
16	13 19·0	13 21·2	12 42·6	1·6	1·4	7·6	6·8	13·6	12·1
17	13 19·3	13 21·4	12 42·8	1·7	1·5	7·7	6·9	13·7	12·2
18	13 19·5	13 21·7	12 43·1	1·8	1·6	7·8	7·0	13·8	12·3
19	13 19·8	13 21·9	12 43·3	1·9	1·7	7·9	7·0	13·9	12·4
20	13 20·0	13 22·2	12 43·6	2·0	1·8	8·0	7·1	14·0	12·5
21	13 20·3	13 22·4	12 43·8	2·1	1·9	8·1	7·2	14·1	12·6
22	13 20·5	13 22·7	12 44·0	2·2	2·0	8·2	7·3	14·2	12·7
23	13 20·8	13 22·9	12 44·3	2·3	2·1	8·3	7·4	14·3	12·8
24	13 21·0	13 23·2	12 44·5	2·4	2·1	8·4	7·5	14·4	12·8
25	13 21·3	13 23·4	12 44·7	2·5	2·2	8·5	7·6	14·5	12·9
26	13 21·5	13 23·7	12 45·0	2·6	2·3	8·6	7·7	14·6	13·0
27	13 21·8	13 23·9	12 45·2	2·7	2·4	8·7	7·8	14·7	13·1
28	13 22·0	13 24·2	12 45·5	2·8	2·5	8·8	7·8	14·8	13·2
29	13 22·3	13 24·4	12 45·7	2·9	2·6	8·9	7·9	14·9	13·3
30	13 22·5	13 24·7	12 45·9	3·0	2·7	9·0	8·0	15·0	13·4
31	13 22·8	13 24·9	12 46·2	3·1	2·8	9·1	8·1	15·1	13·5
32	13 23·0	13 25·2	12 46·4	3·2	2·9	9·2	8·2	15·2	13·6
33	13 23·3	13 25·4	12 46·7	3·3	2·9	9·3	8·3	15·3	13·6
34	13 23·5	13 25·7	12 46·9	3·4	3·0	9·4	8·4	15·4	13·7
35	13 23·8	13 26·0	12 47·1	3·5	3·1	9·5	8·5	15·5	13·8
36	13 24·0	13 26·2	12 47·4	3·6	3·2	9·6	8·6	15·6	13·9
37	13 24·3	13 26·5	12 47·6	3·7	3·3	9·7	8·6	15·7	14·0
38	13 24·5	13 26·7	12 47·9	3·8	3·4	9·8	8·7	15·8	14·1
39	13 24·8	13 27·0	12 48·1	3·9	3·5	9·9	8·8	15·9	14·2
40	13 25·0	13 27·2	12 48·3	4·0	3·6	10·0	8·9	16·0	14·3
41	13 25·3	13 27·5	12 48·6	4·1	3·7	10·1	9·0	16·1	14·4
42	13 25·5	13 27·7	12 48·8	4·2	3·7	10·2	9·1	16·2	14·4
43	13 25·8	13 28·0	12 49·0	4·3	3·8	10·3	9·2	16·3	14·5
44	13 26·0	13 28·2	12 49·3	4·4	3·9	10·4	9·3	16·4	14·6
45	13 26·3	13 28·5	12 49·5	4·5	4·0	10·5	9·4	16·5	14·7
46	13 26·5	13 28·7	12 49·8	4·6	4·1	10·6	9·5	16·6	14·8
47	13 26·8	13 29·0	12 50·0	4·7	4·2	10·7	9·5	16·7	14·9
48	13 27·0	13 29·2	12 50·2	4·8	4·3	10·8	9·6	16·8	15·0
49	13 27·3	13 29·5	12 50·5	4·9	4·4	10·9	9·7	16·9	15·1
50	13 27·5	13 29·7	12 50·7	5·0	4·5	11·0	9·8	17·0	15·2
51	13 27·8	13 30·0	12 51·0	5·1	4·5	11·1	9·9	17·1	15·2
52	13 28·0	13 30·2	12 51·2	5·2	4·6	11·2	10·0	17·2	15·3
53	13 28·3	13 30·5	12 51·4	5·3	4·7	11·3	10·1	17·3	15·4
54	13 28·5	13 30·7	12 51·7	5·4	4·8	11·4	10·2	17·4	15·5
55	13 28·8	13 31·0	12 51·9	5·5	4·9	11·5	10·3	17·5	15·6
56	13 29·0	13 31·2	12 52·1	5·6	5·0	11·6	10·3	17·6	15·7
57	13 29·3	13 31·5	12 52·4	5·7	5·1	11·7	10·4	17·7	15·8
58	13 29·5	13 31·7	12 52·6	5·8	5·2	11·8	10·5	17·8	15·9
59	13 29·8	13 32·0	12 52·9	5·9	5·3	11·9	10·6	17·9	16·0
60	13 30·0	13 32·2	12 53·1	6·0	5·4	12·0	10·7	18·0	16·1

54m	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	13 30·0	13 32·2	12 53·1	0·0	0·0	6·0	5·5	12·0	10·9
01	13 30·3	13 32·5	12 53·3	0·1	0·1	6·1	5·5	12·1	11·0
02	13 30·5	13 32·7	12 53·6	0·2	0·2	6·2	5·6	12·2	11·1
03	13 30·8	13 33·0	12 53·8	0·3	0·3	6·3	5·7	12·3	11·2
04	13 31·0	13 33·2	12 54·1	0·4	0·4	6·4	5·8	12·4	11·3
05	13 31·3	13 33·5	12 54·3	0·5	0·5	6·5	5·9	12·5	11·4
06	13 31·5	13 33·7	12 54·5	0·6	0·5	6·6	6·0	12·6	11·4
07	13 31·8	13 34·0	12 54·8	0·7	0·6	6·7	6·1	12·7	11·5
08	13 32·0	13 34·2	12 55·0	0·8	0·7	6·8	6·2	12·8	11·6
09	13 32·3	13 34·5	12 55·2	0·9	0·8	6·9	6·3	12·9	11·7
10	13 32·5	13 34·7	12 55·5	1·0	0·9	7·0	6·4	13·0	11·8
11	13 32·8	13 35·0	12 55·7	1·1	1·0	7·1	6·4	13·1	11·9
12	13 33·0	13 35·2	12 56·0	1·2	1·1	7·2	6·5	13·2	12·0
13	13 33·3	13 35·5	12 56·2	1·3	1·2	7·3	6·6	13·3	12·1
14	13 33·5	13 35·7	12 56·4	1·4	1·3	7·4	6·7	13·4	12·2
15	13 33·8	13 36·0	12 56·7	1·5	1·4	7·5	6·8	13·5	12·3
16	13 34·0	13 36·2	12 56·9	1·6	1·5	7·6	6·9	13·6	12·4
17	13 34·3	13 36·5	12 57·2	1·7	1·5	7·7	7·0	13·7	12·4
18	13 34·5	13 36·7	12 57·4	1·8	1·6	7·8	7·1	13·8	12·5
19	13 34·8	13 37·0	12 57·6	1·9	1·7	7·9	7·2	13·9	12·6
20	13 35·0	13 37·2	12 57·9	2·0	1·8	8·0	7·3	14·0	12·7
21	13 35·3	13 37·5	12 58·1	2·1	1·9	8·1	7·4	14·1	12·8
22	13 35·5	13 37·7	12 58·3	2·2	2·0	8·2	7·4	14·2	12·9
23	13 35·8	13 38·0	12 58·6	2·3	2·1	8·3	7·5	14·3	13·0
24	13 36·0	13 38·2	12 58·8	2·4	2·2	8·4	7·6	14·4	13·1
25	13 36·3	13 38·5	12 59·1	2·5	2·3	8·5	7·7	14·5	13·2
26	13 36·5	13 38·7	12 59·3	2·6	2·4	8·6	7·8	14·6	13·3
27	13 36·8	13 39·0	12 59·5	2·7	2·5	8·7	7·9	14·7	13·4
28	13 37·0	13 39·2	12 59·8	2·8	2·5	8·8	8·0	14·8	13·4
29	13 37·3	13 39·5	13 00·0	2·9	2·6	8·9	8·1	14·9	13·5
30	13 37·5	13 39·7	13 00·3	3·0	2·7	9·0	8·2	15·0	13·6
31	13 37·8	13 40·0	13 00·5	3·1	2·8	9·1	8·3	15·1	13·7
32	13 38·0	13 40·2	13 00·7	3·2	2·9	9·2	8·4	15·2	13·8
33	13 38·3	13 40·5	13 01·0	3·3	3·0	9·3	8·4	15·3	13·9
34	13 38·5	13 40·7	13 01·2	3·4	3·1	9·4	8·5	15·4	14·0
35	13 38·8	13 41·0	13 01·5	3·5	3·2	9·5	8·6	15·5	14·1
36	13 39·0	13 41·2	13 01·7	3·6	3·3	9·6	8·7	15·6	14·2
37	13 39·3	13 41·5	13 01·9	3·7	3·4	9·7	8·8	15·7	14·3
38	13 39·5	13 41·7	13 02·2	3·8	3·5	9·8	8·9	15·8	14·4
39	13 39·8	13 42·0	13 02·4	3·9	3·5	9·9	9·0	15·9	14·4
40	13 40·0	13 42·2	13 02·6	4·0	3·6	10·0	9·1	16·0	14·5
41	13 40·3	13 42·5	13 02·9	4·1	3·7	10·1	9·2	16·1	14·6
42	13 40·5	13 42·7	13 03·1	4·2	3·8	10·2	9·3	16·2	14·7
43	13 40·8	13 43·0	13 03·4	4·3	3·9	10·3	9·4	16·3	14·8
44	13 41·0	13 43·2	13 03·6	4·4	4·0	10·4	9·4	16·4	14·9
45	13 41·3	13 43·5	13 03·8	4·5	4·1	10·5	9·5	16·5	15·0
46	13 41·5	13 43·7	13 04·1	4·6	4·2	10·6	9·6	16·6	15·1
47	13 41·8	13 44·0	13 04·3	4·7	4·3	10·7	9·7	16·7	15·2
48	13 42·0	13 44·3	13 04·6	4·8	4·4	10·8	9·8	16·8	15·3
49	13 42·3	13 44·5	13 04·8	4·9	4·5	10·9	9·9	16·9	15·4
50	13 42·5	13 44·8	13 05·0	5·0	4·5	11·0	10·0	17·0	15·4
51	13 42·8	13 45·0	13 05·3	5·1	4·6	11·1	10·1	17·1	15·5
52	13 43·0	13 45·3	13 05·5	5·2	4·7	11·2	10·2	17·2	15·6
53	13 43·3	13 45·5	13 05·7	5·3	4·8	11·3	10·3	17·3	15·7
54	13 43·5	13 45·8	13 06·0	5·4	4·9	11·4	10·4	17·4	15·8
55	13 43·8	13 46·0	13 06·2	5·5	5·0	11·5	10·4	17·5	15·9
56	13 44·0	13 46·3	13 06·5	5·6	5·1	11·6	10·5	17·6	16·0
57	13 44·3	13 46·5	13 06·7	5·7	5·2	11·7	10·6	17·7	16·1
58	13 44·5	13 46·8	13 06·9	5·8	5·3	11·8	10·7	17·8	16·2
59	13 44·8	13 47·0	13 07·2	5·9	5·4	11·9	10·8	17·9	16·3
60	13 45·0	13 47·3	13 07·4	6·0	5·5	12·0	10·9	18·0	16·4

55m	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	13 45·0	13 47·3	13 07·4	0·0	0·0	6·0	5·6	12·0	11·1
01	13 45·3	13 47·5	13 07·7	0·1	0·1	6·1	5·6	12·1	11·2
02	13 45·5	13 47·8	13 07·9	0·2	0·2	6·2	5·7	12·2	11·3
03	13 45·8	13 48·0	13 08·1	0·3	0·3	6·3	5·8	12·3	11·4
04	13 46·0	13 48·3	13 08·4	0·4	0·4	6·4	5·9	12·4	11·5
05	13 46·3	13 48·5	13 08·6	0·5	0·5	6·5	6·0	12·5	11·6
06	13 46·5	13 48·8	13 08·8	0·6	0·6	6·6	6·1	12·6	11·7
07	13 46·8	13 49·0	13 09·1	0·7	0·6	6·7	6·2	12·7	11·7
08	13 47·0	13 49·3	13 09·3	0·8	0·7	6·8	6·3	12·8	11·8
09	13 47·3	13 49·5	13 09·6	0·9	0·8	6·9	6·4	12·9	11·9
10	13 47·5	13 49·8	13 09·8	1·0	0·9	7·0	6·5	13·0	12·0
11	13 47·8	13 50·0	13 10·0	1·1	1·0	7·1	6·6	13·1	12·1
12	13 48·0	13 50·3	13 10·3	1·2	1·1	7·2	6·7	13·2	12·2
13	13 48·3	13 50·5	13 10·5	1·3	1·2	7·3	6·8	13·3	12·3
14	13 48·5	13 50·8	13 10·8	1·4	1·3	7·4	6·8	13·4	12·4
15	13 48·8	13 51·0	13 11·0	1·5	1·4	7·5	6·9	13·5	12·5
16	13 49·0	13 51·3	13 11·2	1·6	1·5	7·6	7·0	13·6	12·6
17	13 49·3	13 51·5	13 11·5	1·7	1·6	7·7	7·1	13·7	12·7
18	13 49·5	13 51·8	13 11·7	1·8	1·7	7·8	7·2	13·8	12·8
19	13 49·8	13 52·0	13 12·0	1·9	1·8	7·9	7·3	13·9	12·9
20	13 50·0	13 52·3	13 12·2	2·0	1·9	8·0	7·4	14·0	13·0
21	13 50·3	13 52·5	13 12·4	2·1	1·9	8·1	7·5	14·1	13·0
22	13 50·5	13 52·8	13 12·7	2·2	2·0	8·2	7·6	14·2	13·1
23	13 50·8	13 53·0	13 12·9	2·3	2·1	8·3	7·7	14·3	13·2
24	13 51·0	13 53·3	13 13·1	2·4	2·2	8·4	7·8	14·4	13·3
25	13 51·3	13 53·5	13 13·4	2·5	2·3	8·5	7·9	14·5	13·4
26	13 51·5	13 53·8	13 13·6	2·6	2·4	8·6	8·0	14·6	13·5
27	13 51·8	13 54·0	13 13·9	2·7	2·5	8·7	8·0	14·7	13·6
28	13 52·0	13 54·3	13 14·1	2·8	2·6	8·8	8·1	14·8	13·7
29	13 52·3	13 54·5	13 14·3	2·9	2·7	8·9	8·2	14·9	13·8
30	13 52·5	13 54·8	13 14·6	3·0	2·8	9·0	8·3	15·0	13·9
31	13 52·8	13 55·0	13 14·8	3·1	2·9	9·1	8·4	15·1	14·0
32	13 53·0	13 55·3	13 15·1	3·2	3·0	9·2	8·5	15·2	14·1
33	13 53·3	13 55·5	13 15·3	3·3	3·1	9·3	8·6	15·3	14·2
34	13 53·5	13 55·8	13 15·5	3·4	3·1	9·4	8·7	15·4	14·2
35	13 53·8	13 56·0	13 15·8	3·5	3·2	9·5	8·8	15·5	14·3
36	13 54·0	13 56·3	13 16·0	3·6	3·3	9·6	8·9	15·6	14·4
37	13 54·3	13 56·5	13 16·2	3·7	3·4	9·7	9·0	15·7	14·5
38	13 54·5	13 56·8	13 16·5	3·8	3·5	9·8	9·1	15·8	14·6
39	13 54·8	13 57·0	13 16·7	3·9	3·6	9·9	9·2	15·9	14·7
40	13 55·0	13 57·3	13 17·0	4·0	3·7	10·0	9·3	16·0	14·8
41	13 55·3	13 57·5	13 17·2	4·1	3·8	10·1	9·3	16·1	14·9
42	13 55·5	13 57·8	13 17·4	4·2	3·9	10·2	9·4	16·2	15·0
43	13 55·8	13 58·0	13 17·7	4·3	4·0	10·3	9·5	16·3	15·1
44	13 56·0	13 58·3	13 17·9	4·4	4·1	10·4	9·6	16·4	15·2
45	13 56·3	13 58·5	13 18·2	4·5	4·2	10·5	9·7	16·5	15·3
46	13 56·5	13 58·8	13 18·4	4·6	4·3	10·6	9·8	16·6	15·4
47	13 56·8	13 59·0	13 18·6	4·7	4·3	10·7	9·9	16·7	15·4
48	13 57·0	13 59·3	13 18·9	4·8	4·4	10·8	10·0	16·8	15·5
49	13 57·3	13 59·5	13 19·1	4·9	4·5	10·9	10·1	16·9	15·6
50	13 57·5	13 59·8	13 19·3	5·0	4·6	11·0	10·2	17·0	15·7
51	13 57·8	14 00·0	13 19·6	5·1	4·7	11·1	10·3	17·1	15·8
52	13 58·0	14 00·3	13 19·8	5·2	4·8	11·2	10·4	17·2	15·9
53	13 58·3	14 00·5	13 20·1	5·3	4·9	11·3	10·5	17·3	16·0
54	13 58·5	14 00·8	13 20·3	5·4	5·0	11·4	10·5	17·4	16·1
55	13 58·8	14 01·0	13 20·5	5·5	5·1	11·5	10·6	17·5	16·2
56	13 59·0	14 01·3	13 20·8	5·6	5·2	11·6	10·7	17·6	16·3
57	13 59·3	14 01·5	13 21·0	5·7	5·3	11·7	10·8	17·7	16·4
58	13 59·5	14 01·8	13 21·3	5·8	5·4	11·8	10·9	17·8	16·5
59	13 59·8	14 02·0	13 21·5	5·9	5·5	11·9	11·0	17·9	16·6
60	14 00·0	14 02·3	13 21·7	6·0	5·6	12·0	11·1	18·0	16·7

m 56	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	° ′	° ′	° ′	′	′	′	′	′	′
00	14 00·0	14 02·3	13 21·7	0·0	0·0	6·0	5·7	12·0	11·3
01	14 00·3	14 02·6	13 22·0	0·1	0·1	6·1	5·7	12·1	11·4
02	14 00·5	14 02·8	13 22·2	0·2	0·2	6·2	5·8	12·2	11·5
03	14 00·8	14 03·1	13 22·4	0·3	0·3	6·3	5·9	12·3	11·6
04	14 01·0	14 03·3	13 22·7	0·4	0·4	6·4	6·0	12·4	11·7
05	14 01·3	14 03·6	13 22·9	0·5	0·5	6·5	6·1	12·5	11·8
06	14 01·5	14 03·8	13 23·2	0·6	0·6	6·6	6·2	12·6	11·9
07	14 01·8	14 04·1	13 23·4	0·7	0·7	6·7	6·3	12·7	12·0
08	14 02·0	14 04·3	13 23·6	0·8	0·8	6·8	6·4	12·8	12·1
09	14 02·3	14 04·6	13 23·9	0·9	0·8	6·9	6·5	12·9	12·1
10	14 02·5	14 04·8	13 24·1	1·0	0·9	7·0	6·6	13·0	12·2
11	14 02·8	14 05·1	13 24·4	1·1	1·0	7·1	6·7	13·1	12·3
12	14 03·0	14 05·3	13 24·6	1·2	1·1	7·2	6·8	13·2	12·4
13	14 03·3	14 05·6	13 24·8	1·3	1·2	7·3	6·9	13·3	12·5
14	14 03·5	14 05·8	13 25·1	1·4	1·3	7·4	7·0	13·4	12·6
15	14 03·8	14 06·1	13 25·3	1·5	1·4	7·5	7·1	13·5	12·7
16	14 04·0	14 06·3	13 25·6	1·6	1·5	7·6	7·2	13·6	12·8
17	14 04·3	14 06·6	13 25·8	1·7	1·6	7·7	7·3	13·7	12·9
18	14 04·5	14 06·8	13 26·0	1·8	1·7	7·8	7·3	13·8	13·0
19	14 04·8	14 07·1	13 26·3	1·9	1·8	7·9	7·4	13·9	13·1
20	14 05·0	14 07·3	13 26·5	2·0	1·9	8·0	7·5	14·0	13·2
21	14 05·3	14 07·6	13 26·7	2·1	2·0	8·1	7·6	14·1	13·3
22	14 05·5	14 07·8	13 27·0	2·2	2·1	8·2	7·7	14·2	13·4
23	14 05·8	14 08·1	13 27·2	2·3	2·2	8·3	7·8	14·3	13·5
24	14 06·0	14 08·3	13 27·5	2·4	2·3	8·4	7·9	14·4	13·6
25	14 06·3	14 08·6	13 27·7	2·5	2·4	8·5	8·0	14·5	13·7
26	14 06·5	14 08·8	13 27·9	2·6	2·4	8·6	8·1	14·6	13·7
27	14 06·8	14 09·1	13 28·2	2·7	2·5	8·7	8·2	14·7	13·8
28	14 07·0	14 09·3	13 28·4	2·8	2·6	8·8	8·3	14·8	13·9
29	14 07·3	14 09·6	13 28·7	2·9	2·7	8·9	8·4	14·9	14·0
30	14 07·5	14 09·8	13 28·9	3·0	2·8	9·0	8·5	15·0	14·1
31	14 07·8	14 10·1	13 29·1	3·1	2·9	9·1	8·6	15·1	14·2
32	14 08·0	14 10·3	13 29·4	3·2	3·0	9·2	8·7	15·2	14·3
33	14 08·3	14 10·6	13 29·6	3·3	3·1	9·3	8·8	15·3	14·4
34	14 08·5	14 10·8	13 29·8	3·4	3·2	9·4	8·9	15·4	14·5
35	14 08·8	14 11·1	13 30·1	3·5	3·3	9·5	8·9	15·5	14·6
36	14 09·0	14 11·3	13 30·3	3·6	3·4	9·6	9·0	15·6	14·7
37	14 09·3	14 11·6	13 30·6	3·7	3·5	9·7	9·1	15·7	14·8
38	14 09·5	14 11·8	13 30·8	3·8	3·6	9·8	9·2	15·8	14·9
39	14 09·8	14 12·1	13 31·0	3·9	3·7	9·9	9·3	15·9	15·0
40	14 10·0	14 12·3	13 31·3	4·0	3·8	10·0	9·4	16·0	15·1
41	14 10·3	14 12·6	13 31·5	4·1	3·9	10·1	9·5	16·1	15·2
42	14 10·5	14 12·8	13 31·8	4·2	4·0	10·2	9·6	16·2	15·3
43	14 10·8	14 13·1	13 32·0	4·3	4·0	10·3	9·7	16·3	15·3
44	14 11·0	14 13·3	13 32·2	4·4	4·1	10·4	9·8	16·4	15·4
45	14 11·3	14 13·6	13 32·5	4·5	4·2	10·5	9·9	16·5	15·5
46	14 11·5	14 13·8	13 32·7	4·6	4·3	10·6	10·0	16·6	15·6
47	14 11·8	14 14·1	13 32·9	4·7	4·4	10·7	10·1	16·7	15·7
48	14 12·0	14 14·3	13 33·2	4·8	4·5	10·8	10·2	16·8	15·8
49	14 12·3	14 14·6	13 33·4	4·9	4·6	10·9	10·3	16·9	15·9
50	14 12·5	14 14·8	13 33·7	5·0	4·7	11·0	10·4	17·0	16·0
51	14 12·8	14 15·1	13 33·9	5·1	4·8	11·1	10·5	17·1	16·1
52	14 13·0	14 15·3	13 34·1	5·2	4·9	11·2	10·5	17·2	16·2
53	14 13·3	14 15·6	13 34·4	5·3	5·0	11·3	10·6	17·3	16·3
54	14 13·5	14 15·8	13 34·6	5·4	5·1	11·4	10·7	17·4	16·4
55	14 13·8	14 16·1	13 34·9	5·5	5·2	11·5	10·8	17·5	16·5
56	14 14·0	14 16·3	13 35·1	5·6	5·3	11·6	10·9	17·6	16·6
57	14 14·3	14 16·6	13 35·3	5·7	5·4	11·7	11·0	17·7	16·7
58	14 14·5	14 16·8	13 35·6	5·8	5·5	11·8	11·1	17·8	16·8
59	14 14·8	14 17·1	13 35·8	5·9	5·6	11·9	11·2	17·9	16·9
60	14 15·0	14 17·3	13 36·1	6·0	5·7	12·0	11·3	18·0	17·0

m 57	SUN PLANETS	ARIES	MOON	v or d	Corr^n	v or d	Corr^n	v or d	Corr^n
s	° ′	° ′	° ′	′	′	′	′	′	′
00	14 15·0	14 17·3	13 36·1	0·0	0·0	6·0	5·8	12·0	11·5
01	14 15·3	14 17·6	13 36·3	0·1	0·1	6·1	5·8	12·1	11·6
02	14 15·5	14 17·8	13 36·5	0·2	0·2	6·2	5·9	12·2	11·7
03	14 15·8	14 18·1	13 36·8	0·3	0·3	6·3	6·0	12·3	11·8
04	14 16·0	14 18·3	13 37·0	0·4	0·4	6·4	6·1	12·4	11·9
05	14 16·3	14 18·6	13 37·2	0·5	0·5	6·5	6·2	12·5	12·0
06	14 16·5	14 18·8	13 37·5	0·6	0·6	6·6	6·3	12·6	12·1
07	14 16·8	14 19·1	13 37·7	0·7	0·7	6·7	6·4	12·7	12·2
08	14 17·0	14 19·3	13 38·0	0·8	0·8	6·8	6·5	12·8	12·3
09	14 17·3	14 19·6	13 38·2	0·9	0·9	6·9	6·6	12·9	12·4
10	14 17·5	14 19·8	13 38·4	1·0	1·0	7·0	6·7	13·0	12·5
11	14 17·8	14 20·1	13 38·7	1·1	1·1	7·1	6·8	13·1	12·6
12	14 18·0	14 20·3	13 38·9	1·2	1·2	7·2	6·9	13·2	12·7
13	14 18·3	14 20·6	13 39·2	1·3	1·2	7·3	7·0	13·3	12·7
14	14 18·5	14 20·9	13 39·4	1·4	1·3	7·4	7·1	13·4	12·8
15	14 18·8	14 21·1	13 39·6	1·5	1·4	7·5	7·2	13·5	12·9
16	14 19·0	14 21·4	13 39·9	1·6	1·5	7·6	7·3	13·6	13·0
17	14 19·3	14 21·6	13 40·1	1·7	1·6	7·7	7·4	13·7	13·1
18	14 19·5	14 21·9	13 40·3	1·8	1·7	7·8	7·5	13·8	13·2
19	14 19·8	14 22·1	13 40·6	1·9	1·8	7·9	7·6	13·9	13·3
20	14 20·0	14 22·4	13 40·8	2·0	1·9	8·0	7·7	14·0	13·4
21	14 20·3	14 22·6	13 41·1	2·1	2·0	8·1	7·8	14·1	13·5
22	14 20·5	14 22·9	13 41·3	2·2	2·1	8·2	7·9	14·2	13·6
23	14 20·8	14 23·1	13 41·5	2·3	2·2	8·3	8·0	14·3	13·7
24	14 21·0	14 23·4	13 41·8	2·4	2·3	8·4	8·1	14·4	13·8
25	14 21·3	14 23·6	13 42·0	2·5	2·4	8·5	8·1	14·5	13·9
26	14 21·5	14 23·9	13 42·3	2·6	2·5	8·6	8·2	14·6	14·0
27	14 21·8	14 24·1	13 42·5	2·7	2·6	8·7	8·3	14·7	14·1
28	14 22·0	14 24·4	13 42·7	2·8	2·7	8·8	8·4	14·8	14·2
29	14 22·3	14 24·6	13 43·0	2·9	2·8	8·9	8·5	14·9	14·3
30	14 22·5	14 24·9	13 43·2	3·0	2·9	9·0	8·6	15·0	14·4
31	14 22·8	14 25·1	13 43·4	3·1	3·0	9·1	8·7	15·1	14·5
32	14 23·0	14 25·4	13 43·7	3·2	3·1	9·2	8·8	15·2	14·6
33	14 23·3	14 25·6	13 43·9	3·3	3·2	9·3	8·9	15·3	14·7
34	14 23·5	14 25·9	13 44·2	3·4	3·3	9·4	9·0	15·4	14·8
35	14 23·8	14 26·1	13 44·4	3·5	3·4	9·5	9·1	15·5	14·9
36	14 24·0	14 26·4	13 44·6	3·6	3·5	9·6	9·2	15·6	15·0
37	14 24·3	14 26·6	13 44·9	3·7	3·5	9·7	9·3	15·7	15·0
38	14 24·5	14 26·9	13 45·1	3·8	3·6	9·8	9·4	15·8	15·1
39	14 24·8	14 27·1	13 45·4	3·9	3·7	9·9	9·5	15·9	15·2
40	14 25·0	14 27·4	13 45·6	4·0	3·8	10·0	9·6	16·0	15·3
41	14 25·3	14 27·6	13 45·8	4·1	3·9	10·1	9·7	16·1	15·4
42	14 25·5	14 27·9	13 46·1	4·2	4·0	10·2	9·8	16·2	15·5
43	14 25·8	14 28·1	13 46·3	4·3	4·1	10·3	9·9	16·3	15·6
44	14 26·0	14 28·4	13 46·5	4·4	4·2	10·4	10·0	16·4	15·7
45	14 26·3	14 28·6	13 46·8	4·5	4·3	10·5	10·1	16·5	15·8
46	14 26·5	14 28·9	13 47·0	4·6	4·4	10·6	10·2	16·6	15·9
47	14 26·8	14 29·1	13 47·3	4·7	4·5	10·7	10·3	16·7	16·0
48	14 27·0	14 29·4	13 47·5	4·8	4·6	10·8	10·4	16·8	16·1
49	14 27·3	14 29·6	13 47·7	4·9	4·7	10·9	10·4	16·9	16·2
50	14 27·5	14 29·9	13 48·0	5·0	4·8	11·0	10·5	17·0	16·3
51	14 27·8	14 30·1	13 48·2	5·1	4·9	11·1	10·6	17·1	16·4
52	14 28·0	14 30·4	13 48·5	5·2	5·0	11·2	10·7	17·2	16·5
53	14 28·3	14 30·6	13 48·7	5·3	5·1	11·3	10·8	17·3	16·6
54	14 28·5	14 30·9	13 48·9	5·4	5·2	11·4	10·9	17·4	16·7
55	14 28·8	14 31·1	13 49·2	5·5	5·3	11·5	11·0	17·5	16·8
56	14 29·0	14 31·4	13 49·4	5·6	5·4	11·6	11·1	17·6	16·9
57	14 29·3	14 31·6	13 49·7	5·7	5·5	11·7	11·2	17·7	17·0
58	14 29·5	14 31·9	13 49·9	5·8	5·6	11·8	11·3	17·8	17·1
59	14 29·8	14 32·1	13 50·1	5·9	5·7	11·9	11·4	17·9	17·2
60	14 30·0	14 32·4	13 50·4	6·0	5·8	12·0	11·5	18·0	17·3

m 58	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	14 30·0	14 32·4	13 50·4	0·0	0·0	6·0	5·9	12·0	11·7
01	14 30·3	14 32·6	13 50·6	0·1	0·1	6·1	5·9	12·1	11·8
02	14 30·5	14 32·9	13 50·8	0·2	0·2	6·2	6·0	12·2	11·9
03	14 30·8	14 33·1	13 51·1	0·3	0·3	6·3	6·1	12·3	12·0
04	14 31·0	14 33·4	13 51·3	0·4	0·4	6·4	6·2	12·4	12·1
05	14 31·3	14 33·6	13 51·6	0·5	0·5	6·5	6·3	12·5	12·2
06	14 31·5	14 33·9	13 51·8	0·6	0·6	6·6	6·4	12·6	12·3
07	14 31·8	14 34·1	13 52·0	0·7	0·7	6·7	6·5	12·7	12·4
08	14 32·0	14 34·4	13 52·3	0·8	0·8	6·8	6·6	12·8	12·5
09	14 32·3	14 34·6	13 52·5	0·9	0·9	6·9	6·7	12·9	12·6
10	14 32·5	14 34·9	13 52·8	1·0	1·0	7·0	6·8	13·0	12·7
11	14 32·8	14 35·1	13 53·0	1·1	1·1	7·1	6·9	13·1	12·8
12	14 33·0	14 35·4	13 53·2	1·2	1·2	7·2	7·0	13·2	12·9
13	14 33·3	14 35·6	13 53·5	1·3	1·3	7·3	7·1	13·3	13·0
14	14 33·5	14 35·9	13 53·7	1·4	1·4	7·4	7·2	13·4	13·1
15	14 33·8	14 36·1	13 53·9	1·5	1·5	7·5	7·3	13·5	13·2
16	14 34·0	14 36·4	13 54·2	1·6	1·6	7·6	7·4	13·6	13·3
17	14 34·3	14 36·6	13 54·4	1·7	1·7	7·7	7·5	13·7	13·4
18	14 34·5	14 36·9	13 54·7	1·8	1·8	7·8	7·6	13·8	13·5
19	14 34·8	14 37·1	13 54·9	1·9	1·9	7·9	7·7	13·9	13·6
20	14 35·0	14 37·4	13 55·1	2·0	2·0	8·0	7·8	14·0	13·7
21	14 35·3	14 37·6	13 55·4	2·1	2·0	8·1	7·9	14·1	13·7
22	14 35·5	14 37·9	13 55·6	2·2	2·1	8·2	8·0	14·2	13·8
23	14 35·8	14 38·1	13 55·9	2·3	2·2	8·3	8·1	14·3	13·9
24	14 36·0	14 38·4	13 56·1	2·4	2·3	8·4	8·2	14·4	14·0
25	14 36·3	14 38·6	13 56·3	2·5	2·4	8·5	8·3	14·5	14·1
26	14 36·5	14 38·9	13 56·6	2·6	2·5	8·6	8·4	14·6	14·2
27	14 36·8	14 39·2	13 56·8	2·7	2·6	8·7	8·5	14·7	14·3
28	14 37·0	14 39·4	13 57·0	2·8	2·7	8·8	8·6	14·8	14·4
29	14 37·3	14 39·7	13 57·3	2·9	2·8	8·9	8·7	14·9	14·5
30	14 37·5	14 39·9	13 57·5	3·0	2·9	9·0	8·8	15·0	14·6
31	14 37·8	14 40·2	13 57·8	3·1	3·0	9·1	8·9	15·1	14·7
32	14 38·0	14 40·4	13 58·0	3·2	3·1	9·2	9·0	15·2	14·8
33	14 38·3	14 40·7	13 58·2	3·3	3·2	9·3	9·1	15·3	14·9
34	14 38·5	14 40·9	13 58·5	3·4	3·3	9·4	9·2	15·4	15·0
35	14 38·8	14 41·2	13 58·7	3·5	3·4	9·5	9·3	15·5	15·1
36	14 39·0	14 41·4	13 59·0	3·6	3·5	9·6	9·4	15·6	15·2
37	14 39·3	14 41·7	13 59·2	3·7	3·6	9·7	9·5	15·7	15·3
38	14 39·5	14 41·9	13 59·4	3·8	3·7	9·8	9·6	15·8	15·4
39	14 39·8	14 42·2	13 59·7	3·9	3·8	9·9	9·7	15·9	15·5
40	14 40·0	14 42·4	13 59·9	4·0	3·9	10·0	9·8	16·0	15·6
41	14 40·3	14 42·7	14 00·1	4·1	4·0	10·1	9·8	16·1	15·7
42	14 40·5	14 42·9	14 00·4	4·2	4·1	10·2	9·9	16·2	15·8
43	14 40·8	14 43·2	14 00·6	4·3	4·2	10·3	10·0	16·3	15·9
44	14 41·0	14 43·4	14 00·9	4·4	4·3	10·4	10·1	16·4	16·0
45	14 41·3	14 43·7	14 01·1	4·5	4·4	10·5	10·2	16·5	16·1
46	14 41·5	14 43·9	14 01·3	4·6	4·5	10·6	10·3	16·6	16·2
47	14 41·8	14 44·2	14 01·6	4·7	4·6	10·7	10·4	16·7	16·3
48	14 42·0	14 44·4	14 01·8	4·8	4·7	10·8	10·5	16·8	16·4
49	14 42·3	14 44·7	14 02·1	4·9	4·8	10·9	10·6	16·9	16·5
50	14 42·5	14 44·9	14 02·3	5·0	4·9	11·0	10·7	17·0	16·6
51	14 42·8	14 45·2	14 02·5	5·1	5·0	11·1	10·8	17·1	16·7
52	14 43·0	14 45·4	14 02·8	5·2	5·1	11·2	10·9	17·2	16·8
53	14 43·3	14 45·7	14 03·0	5·3	5·2	11·3	11·0	17·3	16·9
54	14 43·5	14 45·9	14 03·3	5·4	5·3	11·4	11·1	17·4	17·0
55	14 43·8	14 46·2	14 03·5	5·5	5·4	11·5	11·2	17·5	17·1
56	14 44·0	14 46·4	14 03·7	5·6	5·5	11·6	11·3	17·6	17·2
57	14 44·3	14 46·7	14 04·0	5·7	5·6	11·7	11·4	17·7	17·3
58	14 44·5	14 46·9	14 04·2	5·8	5·7	11·8	11·5	17·8	17·4
59	14 44·8	14 47·2	14 04·4	5·9	5·8	11·9	11·6	17·9	17·5
60	14 45·0	14 47·4	14 04·7	6·0	5·9	12·0	11·7	18·0	17·6

m 59	SUN PLANETS	ARIES	MOON	v or d	Corrn	v or d	Corrn	v or d	Corrn
s	° ′	° ′	° ′	′	′	′	′	′	′
00	14 45·0	14 47·4	14 04·7	0·0	0·0	6·0	6·0	12·0	11·9
01	14 45·3	14 47·7	14 04·9	0·1	0·1	6·1	6·0	12·1	12·0
02	14 45·5	14 47·9	14 05·2	0·2	0·2	6·2	6·1	12·2	12·1
03	14 45·8	14 48·2	14 05·4	0·3	0·3	6·3	6·2	12·3	12·2
04	14 46·0	14 48·4	14 05·6	0·4	0·4	6·4	6·3	12·4	12·3
05	14 46·3	14 48·7	14 05·9	0·5	0·5	6·5	6·4	12·5	12·4
06	14 46·5	14 48·9	14 06·1	0·6	0·6	6·6	6·5	12·6	12·5
07	14 46·8	14 49·2	14 06·4	0·7	0·7	6·7	6·6	12·7	12·6
08	14 47·0	14 49·4	14 06·6	0·8	0·8	6·8	6·7	12·8	12·7
09	14 47·3	14 49·7	14 06·8	0·9	0·9	6·9	6·8	12·9	12·8
10	14 47·5	14 49·9	14 07·1	1·0	1·0	7·0	6·9	13·0	12·9
11	14 47·8	14 50·2	14 07·3	1·1	1·1	7·1	7·0	13·1	13·0
12	14 48·0	14 50·4	14 07·5	1·2	1·2	7·2	7·1	13·2	13·1
13	14 48·3	14 50·7	14 07·8	1·3	1·3	7·3	7·2	13·3	13·2
14	14 48·5	14 50·9	14 08·0	1·4	1·4	7·4	7·3	13·4	13·3
15	14 48·8	14 51·2	14 08·3	1·5	1·5	7·5	7·4	13·5	13·4
16	14 49·0	14 51·4	14 08·5	1·6	1·6	7·6	7·5	13·6	13·5
17	14 49·3	14 51·7	14 08·7	1·7	1·7	7·7	7·6	13·7	13·6
18	14 49·5	14 51·9	14 09·0	1·8	1·8	7·8	7·7	13·8	13·7
19	14 49·8	14 52·2	14 09·2	1·9	1·9	7·9	7·8	13·9	13·8
20	14 50·0	14 52·4	14 09·5	2·0	2·0	8·0	7·9	14·0	13·9
21	14 50·3	14 52·7	14 09·7	2·1	2·1	8·1	8·0	14·1	14·0
22	14 50·5	14 52·9	14 09·9	2·2	2·2	8·2	8·1	14·2	14·1
23	14 50·8	14 53·2	14 10·2	2·3	2·3	8·3	8·2	14·3	14·2
24	14 51·0	14 53·4	14 10·4	2·4	2·4	8·4	8·3	14·4	14·3
25	14 51·3	14 53·7	14 10·6	2·5	2·5	8·5	8·4	14·5	14·4
26	14 51·5	14 53·9	14 10·9	2·6	2·6	8·6	8·5	14·6	14·5
27	14 51·8	14 54·2	14 11·1	2·7	2·7	8·7	8·6	14·7	14·6
28	14 52·0	14 54·4	14 11·4	2·8	2·8	8·8	8·7	14·8	14·7
29	14 52·3	14 54·7	14 11·6	2·9	2·9	8·9	8·8	14·9	14·8
30	14 52·5	14 54·9	14 11·8	3·0	3·0	9·0	8·9	15·0	14·9
31	14 52·8	14 55·2	14 12·1	3·1	3·1	9·1	9·0	15·1	15·0
32	14 53·0	14 55·4	14 12·3	3·2	3·2	9·2	9·1	15·2	15·1
33	14 53·3	14 55·7	14 12·6	3·3	3·3	9·3	9·2	15·3	15·2
34	14 53·5	14 55·9	14 12·8	3·4	3·4	9·4	9·3	15·4	15·3
35	14 53·8	14 56·2	14 13·0	3·5	3·5	9·5	9·4	15·5	15·4
36	14 54·0	14 56·4	14 13·3	3·6	3·6	9·6	9·5	15·6	15·5
37	14 54·3	14 56·7	14 13·5	3·7	3·7	9·7	9·6	15·7	15·6
38	14 54·5	14 56·9	14 13·8	3·8	3·8	9·8	9·7	15·8	15·7
39	14 54·8	14 57·2	14 14·0	3·9	3·9	9·9	9·8	15·9	15·8
40	14 55·0	14 57·5	14 14·2	4·0	4·0	10·0	9·9	16·0	15·9
41	14 55·3	14 57·7	14 14·5	4·1	4·1	10·1	10·0	16·1	16·0
42	14 55·5	14 58·0	14 14·7	4·2	4·2	10·2	10·1	16·2	16·1
43	14 55·8	14 58·2	14 14·9	4·3	4·3	10·3	10·2	16·3	16·2
44	14 56·0	14 58·5	14 15·2	4·4	4·4	10·4	10·3	16·4	16·3
45	14 56·3	14 58·7	14 15·4	4·5	4·5	10·5	10·4	16·5	16·4
46	14 56·5	14 59·0	14 15·7	4·6	4·6	10·6	10·5	16·6	16·5
47	14 56·8	14 59·2	14 15·9	4·7	4·7	10·7	10·6	16·7	16·6
48	14 57·0	14 59·5	14 16·1	4·8	4·8	10·8	10·7	16·8	16·7
49	14 57·3	14 59·7	14 16·4	4·9	4·9	10·9	10·8	16·9	16·8
50	14 57·5	15 00·0	14 16·6	5·0	5·0	11·0	10·9	17·0	16·9
51	14 57·8	15 00·2	14 16·9	5·1	5·1	11·1	11·0	17·1	17·0
52	14 58·0	15 00·5	14 17·1	5·2	5·2	11·2	11·1	17·2	17·1
53	14 58·3	15 00·7	14 17·3	5·3	5·3	11·3	11·2	17·3	17·2
54	14 58·5	15 01·0	14 17·6	5·4	5·4	11·4	11·3	17·4	17·3
55	14 58·8	15 01·2	14 17·8	5·5	5·5	11·5	11·4	17·5	17·4
56	14 59·0	15 01·5	14 18·0	5·6	5·6	11·6	11·5	17·6	17·5
57	14 59·3	15 01·7	14 18·3	5·7	5·7	11·7	11·6	17·7	17·6
58	14 59·5	15 02·0	14 18·5	5·8	5·8	11·8	11·7	17·8	17·7
59	14 59·8	15 02·2	14 18·8	5·9	5·9	11·9	11·8	17·9	17·8
60	15 00·0	15 02·5	14 19·0	6·0	6·0	12·0	11·9	18·0	17·9

TABLES FOR INTERPOLATING SUNRISE, MOONRISE, ETC.

TABLE I—FOR LATITUDE

Tabular Interval			Difference between the times for consecutive latitudes														
10°	5°	2°	5m	10m	15m	20m	25m	30m	35m	40m	45m	50m	55m	60m	1h05m	1h10m	1h15m	1h20m
° ′	° ′	° ′	m	m	m	m	m	m	m	m	m	m	m	m	h m	h m	h m	h m
0 30	0 15	0 06	0	0	1	1	1	1	1	2	2	2	2	2	0 02	0 02	0 02	0 02
1 00	0 30	0 12	0	1	1	2	2	3	3	3	4	4	4	5	05	05	05	05
1 30	0 45	0 18	1	1	2	3	3	4	4	5	5	6	7	7	07	07	07	07
2 00	1 00	0 24	1	2	3	4	5	5	6	7	7	8	9	10	10	10	10	10
2 30	1 15	0 30	1	2	4	5	6	7	8	9	9	10	11	12	12	13	13	13
3 00	1 30	0 36	1	3	4	6	7	8	9	10	11	12	13	14	0 15	0 15	0 16	0 16
3 30	1 45	0 42	2	3	5	7	8	10	11	12	13	14	16	17	18	18	19	19
4 00	2 00	0 48	2	4	6	8	9	11	13	14	15	16	18	19	20	21	22	22
4 30	2 15	0 54	2	4	7	9	11	13	15	16	18	19	21	22	23	24	25	26
5 00	2 30	1 00	2	5	7	10	12	14	16	18	20	22	23	25	26	27	28	29
5 30	2 45	1 06	3	5	8	11	13	16	18	20	22	24	26	28	0 29	0 30	0 31	0 32
6 00	3 00	1 12	3	6	9	12	14	17	20	22	24	26	29	31	32	33	34	36
6 30	3 15	1 18	3	6	10	13	16	19	22	24	26	29	31	34	36	37	38	40
7 00	3 30	1 24	3	7	10	14	17	20	23	26	29	31	34	37	39	41	42	44
7 30	3 45	1 30	4	7	11	15	18	22	25	28	31	34	37	40	43	44	46	48
8 00	4 00	1 36	4	8	12	16	20	23	27	30	34	37	41	44	0 47	0 48	0 51	0 53
8 30	4 15	1 42	4	8	13	17	21	25	29	33	36	40	44	48	0 51	0 53	0 56	0 58
9 00	4 30	1 48	4	9	13	18	22	27	31	35	39	43	47	52	0 55	0 58	1 01	1 04
9 30	4 45	1 54	5	9	14	19	24	28	33	38	42	47	51	56	1 00	1 04	1 08	1 12
10 00	5 00	2 00	5	10	15	20	25	30	35	40	45	50	55	60	1 05	1 10	1 15	1 20

Table I is for interpolating the LMT of sunrise, twilight, moonrise, etc., for latitude. It is to be entered, in the appropriate column on the left, with the difference between true latitude and the nearest tabular latitude which is *less* than the true latitude; and with the argument at the top which is the nearest value of the difference between the times for the tabular latitude and the next higher one; the correction so obtained is applied to the time for the tabular latitude; the sign of the correction can be seen by inspection. It is to be noted that the interpolation is not linear, so that when using this table it is essential to take out the tabular phenomenon for the latitude *less* than the true latitude.

TABLE II—FOR LONGITUDE

Long. East or West	Difference between the times for given date and preceding date (for east longitude) or for given date and following date (for west longitude)																	
	10m	20m	30m	40m	50m	60m	1h + 10m	1h + 20m	1h + 30m	1h + 40m	1h + 50m	1h + 60m	2h10m	2h20m	2h30m	2h40m	2h50m	3h00m
°	m	m	m	m	m	m	m	m	m	m	m	m	h m	h m	h m	h m	h m	h m
0	0	0	0	0	0	0	0	0	0	0	0	0	0 00	0 00	0 00	0 00	0 00	0 00
10	0	1	1	1	1	2	2	2	2	3	3	3	04	04	04	04	05	05
20	1	1	2	2	3	3	4	4	5	6	6	7	07	08	08	09	09	10
30	1	2	2	3	4	5	6	7	7	8	9	10	11	12	12	13	14	15
40	1	2	3	4	6	7	8	9	10	11	12	13	14	16	17	18	19	20
50	1	3	4	6	7	8	10	11	12	14	15	17	0 18	0 19	0 21	0 22	0 24	0 25
60	2	3	5	7	8	10	12	13	15	17	18	20	22	23	25	27	28	30
70	2	4	6	8	10	12	14	16	17	19	21	23	25	27	29	31	33	35
80	2	4	7	9	11	13	16	18	20	22	24	27	29	31	33	36	38	40
90	2	5	7	10	12	15	17	20	22	25	27	30	32	35	37	40	42	45
100	3	6	8	11	14	17	19	22	25	28	31	33	0 36	0 39	0 42	0 44	0 47	0 50
110	3	6	9	12	15	18	21	24	27	31	34	37	40	43	46	49	0 52	0 55
120	3	7	10	13	17	20	23	27	30	33	37	40	43	47	50	53	0 57	1 00
130	4	7	11	14	18	22	25	29	32	36	40	43	47	51	54	0 58	1 01	1 05
140	4	8	12	16	19	23	27	31	35	39	43	47	51	54	0 58	1 02	1 06	1 10
150	4	8	13	17	21	25	29	33	38	42	46	50	0 54	0 58	1 03	1 07	1 11	1 15
160	4	9	13	18	22	27	31	36	40	44	49	53	0 58	1 02	1 07	1 11	1 16	1 20
170	5	9	14	19	24	28	33	38	42	47	52	57	1 01	1 06	1 11	1 16	1 20	1 25
180	5	10	15	20	25	30	35	40	45	50	55	60	1 05	1 10	1 15	1 20	1 25	1 30

Table II is for interpolating the LMT of moonrise, moonset and the Moon's meridian passage for longitude. It is entered with longitude and with the difference between the times for the given date and for the preceding date (in east longitudes) or following date (in west longitudes). The correction is normally *added* for west longitudes and *subtracted* for east longitudes, but if, as occasionally happens, the times become earlier each day instead of later, the signs of the corrections must be reversed.

INDEX TO SELECTED STARS, 2011

Name	No	Mag	SHA	Dec
Acamar	7	3·2	315	S 40
Achernar	5	0·5	335	S 57
Acrux	30	1·3	173	S 63
Adhara	19	1·5	255	S 29
Aldebaran	10	0·9	291	N 17
Alioth	32	1·8	166	N 56
Alkaid	34	1·9	153	N 49
Al Na'ir	55	1·7	28	S 47
Alnilam	15	1·7	276	S 1
Alphard	25	2·0	218	S 9
Alphecca	41	2·2	126	N 27
Alpheratz	1	2·1	358	N 29
Altair	51	0·8	62	N 9
Ankaa	2	2·4	353	S 42
Antares	42	1·0	112	S 26
Arcturus	37	0·0	146	N 19
Atria	43	1·9	108	S 69
Avior	22	1·9	234	S 60
Bellatrix	13	1·6	279	N 6
Betelgeuse	16	Var.*	271	N 7
Canopus	17	−0·7	264	S 53
Capella	12	0·1	281	N 46
Deneb	53	1·3	50	N 45
Denebola	28	2·1	183	N 15
Diphda	4	2·0	349	S 18
Dubhe	27	1·8	194	N 62
Elnath	14	1·7	278	N 29
Eltanin	47	2·2	91	N 51
Enif	54	2·4	34	N 10
Fomalhaut	56	1·2	15	S 30
Gacrux	31	1·6	172	S 57
Gienah	29	2·6	176	S 18
Hadar	35	0·6	149	S 60
Hamal	6	2·0	328	N 24
Kaus Australis	48	1·9	84	S 34
Kochab	40	2·1	137	N 74
Markab	57	2·5	14	N 15
Menkar	8	2·5	314	N 4
Menkent	36	2·1	148	S 36
Miaplacidus	24	1·7	222	S 70
Mirfak	9	1·8	309	N 50
Nunki	50	2·0	76	S 26
Peacock	52	1·9	53	S 57
Pollux	21	1·1	243	N 28
Procyon	20	0·4	245	N 5
Rasalhague	46	2·1	96	N 13
Regulus	26	1·4	208	N 12
Rigel	11	0·1	281	S 8
Rigil Kentaurus	38	−0·3	140	S 61
Sabik	44	2·4	102	S 16
Schedar	3	2·2	350	N 57
Shaula	45	1·6	96	S 37
Sirius	18	−1·5	259	S 17
Spica	33	1·0	159	S 11
Suhail	23	2·2	223	S 43
Vega	49	0·0	81	N 39
Zubenelgenubi	39	2·8	137	S 16

No	Name	Mag	SHA	Dec
1	*Alpheratz*	2·1	358	N 29
2	*Ankaa*	2·4	353	S 42
3	*Schedar*	2·2	350	N 57
4	*Diphda*	2·0	349	S 18
5	*Achernar*	0·5	335	S 57
6	*Hamal*	2·0	328	N 24
7	*Acamar*	3·2	315	S 40
8	*Menkar*	2·5	314	N 4
9	*Mirfak*	1·8	309	N 50
10	*Aldebaran*	0·9	291	N 17
11	*Rigel*	0·1	281	S 8
12	*Capella*	0·1	281	N 46
13	*Bellatrix*	1·6	279	N 6
14	*Elnath*	1·7	278	N 29
15	*Alnilam*	1·7	276	S 1
16	*Betelgeuse*	Var.*	271	N 7
17	*Canopus*	−0·7	264	S 53
18	*Sirius*	−1·5	259	S 17
19	*Adhara*	1·5	255	S 29
20	*Procyon*	0·4	245	N 5
21	*Pollux*	1·1	243	N 28
22	*Avior*	1·9	234	S 60
23	*Suhail*	2·2	223	S 43
24	*Miaplacidus*	1·7	222	S 70
25	*Alphard*	2·0	218	S 9
26	*Regulus*	1·4	208	N 12
27	*Dubhe*	1·8	194	N 62
28	*Denebola*	2·1	183	N 15
29	*Gienah*	2·6	176	S 18
30	*Acrux*	1·3	173	S 63
31	*Gacrux*	1·6	172	S 57
32	*Alioth*	1·8	166	N 56
33	*Spica*	1·0	159	S 11
34	*Alkaid*	1·9	153	N 49
35	*Hadar*	0·6	149	S 60
36	*Menkent*	2·1	148	S 36
37	*Arcturus*	0·0	146	N 19
38	*Rigil Kentaurus*	−0·3	140	S 61
39	*Zubenelgenubi*	2·8	137	S 16
40	*Kochab*	2·1	137	N 74
41	*Alphecca*	2·2	126	N 27
42	*Antares*	1·0	112	S 26
43	*Atria*	1·9	108	S 69
44	*Sabik*	2·4	102	S 16
45	*Shaula*	1·6	96	S 37
46	*Rasalhague*	2·1	96	N 13
47	*Eltanin*	2·2	91	N 51
48	*Kaus Australis*	1·9	84	S 34
49	*Vega*	0·0	81	N 39
50	*Nunki*	2·0	76	S 26
51	*Altair*	0·8	62	N 9
52	*Peacock*	1·9	53	S 57
53	*Deneb*	1·3	50	N 45
54	*Enif*	2·4	34	N 10
55	*Al Na'ir*	1·7	28	S 47
56	*Fomalhaut*	1·2	15	S 30
57	*Markab*	2·5	14	N 15

*0·1 · 1·2

ALTITUDE CORRECTION TABLES 0°–35°— MOON

App. Alt.	0° – 4° Corrⁿ	5° – 9° Corrⁿ	10° – 14° Corrⁿ	15° – 19° Corrⁿ	20° – 24° Corrⁿ	25° – 29° Corrⁿ	30° – 34° Corrⁿ	App. Alt.
′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	′
00	0 34·5	5 58·2	10 62·1	15 62·8	20 62·2	25 60·8	30 58·9	00
10	36·5	58·5	62·2	62·8	62·2	60·8	58·8	10
20	38·3	58·7	62·2	62·8	62·1	60·7	58·8	20
30	40·0	58·9	62·3	62·8	62·1	60·7	58·7	30
40	41·5	59·1	62·3	62·8	62·0	60·6	58·6	40
50	42·9	59·3	62·4	62·7	62·0	60·6	58·5	50
00	1 44·2	6 59·5	11 62·4	16 62·7	21 62·0	26 60·5	31 58·5	00
10	45·4	59·7	62·4	62·7	61·9	60·4	58·4	10
20	46·5	59·9	62·5	62·7	61·9	60·4	58·3	20
30	47·5	60·0	62·5	62·7	61·9	60·3	58·2	30
40	48·4	60·2	62·5	62·7	61·8	60·3	58·2	40
50	49·3	60·3	62·6	62·7	61·8	60·2	58·1	50
00	2 50·1	7 60·5	12 62·6	17 62·7	22 61·7	27 60·1	32 58·0	00
10	50·8	60·6	62·6	62·6	61·7	60·1	57·9	10
20	51·5	60·7	62·6	62·6	61·6	60·0	57·8	20
30	52·2	60·9	62·7	62·6	61·6	59·9	57·8	30
40	52·8	61·0	62·7	62·6	61·6	59·9	57·7	40
50	53·4	61·1	62·7	62·6	61·5	59·8	57·6	50
00	3 53·9	8 61·2	13 62·7	18 62·5	23 61·5	28 59·7	33 57·5	00
10	54·4	61·3	62·7	62·5	61·4	59·7	57·4	10
20	54·9	61·4	62·7	62·5	61·4	59·6	57·4	20
30	55·3	61·5	62·8	62·5	61·3	59·5	57·3	30
40	55·7	61·6	62·8	62·4	61·3	59·5	57·2	40
50	56·1	61·6	62·8	62·4	61·2	59·4	57·1	50
00	4 56·4	9 61·7	14 62·8	19 62·4	24 61·2	29 59·3	34 57·0	00
10	56·8	61·8	62·8	62·4	61·1	59·3	56·9	10
20	57·1	61·9	62·8	62·3	61·1	59·2	56·9	20
30	57·4	61·9	62·8	62·3	61·0	59·1	56·8	30
40	57·7	62·0	62·8	62·3	61·0	59·1	56·7	40
50	58·0	62·1	62·8	62·2	60·9	59·0	56·6	50

HP	L	U	L	U	L	U	L	U	L	U	L	U	L	U	HP
′	′	′	′	′	′	′	′	′	′	′	′	′	′	′	′
54·0	0·3	0·9	0·3	0·9	0·4	1·0	0·5	1·1	0·6	1·2	0·7	1·3	0·9	1·5	54·0
54·3	0·7	1·1	0·7	1·2	0·8	1·2	0·8	1·3	0·9	1·4	1·1	1·5	1·2	1·7	54·3
54·6	1·1	1·4	1·1	1·4	1·1	1·4	1·2	1·5	1·3	1·6	1·4	1·7	1·5	1·8	54·6
54·9	1·4	1·6	1·5	1·6	1·5	1·6	1·6	1·7	1·6	1·8	1·8	1·9	1·9	2·0	54·9
55·2	1·8	1·8	1·8	1·8	1·9	1·8	1·9	1·9	2·0	2·0	2·1	2·1	2·2	2·2	55·2
55·5	2·2	2·0	2·2	2·0	2·3	2·1	2·3	2·1	2·4	2·2	2·4	2·3	2·5	2·4	55·5
55·8	2·6	2·2	2·6	2·2	2·6	2·3	2·7	2·3	2·7	2·4	2·8	2·4	2·9	2·5	55·8
56·1	3·0	2·4	3·0	2·5	3·0	2·5	3·0	2·5	3·1	2·6	3·1	2·6	3·2	2·7	56·1
56·4	3·3	2·7	3·4	2·7	3·4	2·7	3·4	2·7	3·4	2·8	3·5	2·8	3·5	2·9	56·4
56·7	3·7	2·9	3·7	2·9	3·8	2·9	3·8	2·9	3·8	3·0	3·8	3·0	3·9	3·0	56·7
57·0	4·1	3·1	4·1	3·1	4·1	3·1	4·1	3·1	4·2	3·2	4·2	3·2	4·2	3·2	57·0
57·3	4·5	3·3	4·5	3·3	4·5	3·3	4·5	3·3	4·5	3·3	4·5	3·4	4·6	3·4	57·3
57·6	4·9	3·5	4·9	3·5	4·9	3·5	4·9	3·5	4·9	3·5	4·9	3·5	4·9	3·6	57·6
57·9	5·3	3·8	5·3	3·8	5·2	3·8	5·2	3·7	5·2	3·7	5·2	3·7	5·2	3·7	57·9
58·2	5·6	4·0	5·6	4·0	5·6	4·0	5·6	4·0	5·6	3·9	5·6	3·9	5·6	3·9	58·2
58·5	6·0	4·2	6·0	4·2	6·0	4·2	6·0	4·2	6·0	4·1	5·9	4·1	5·9	4·1	58·5
58·8	6·4	4·4	6·4	4·4	6·4	4·4	6·3	4·4	6·3	4·3	6·3	4·3	6·2	4·2	58·8
59·1	6·8	4·6	6·8	4·6	6·7	4·6	6·7	4·6	6·7	4·5	6·6	4·5	6·6	4·4	59·1
59·4	7·2	4·8	7·1	4·8	7·1	4·8	7·1	4·8	7·0	4·7	7·0	4·7	6·9	4·6	59·4
59·7	7·5	5·1	7·5	5·0	7·5	5·0	7·5	5·0	7·4	4·9	7·3	4·8	7·2	4·8	59·7
60·0	7·9	5·3	7·9	5·3	7·9	5·2	7·8	5·2	7·8	5·1	7·7	5·0	7·6	4·9	60·0
60·3	8·3	5·5	8·3	5·5	8·2	5·4	8·2	5·4	8·1	5·3	8·0	5·2	7·9	5·1	60·3
60·6	8·7	5·7	8·7	5·7	8·6	5·7	8·6	5·6	8·5	5·5	8·4	5·4	8·2	5·3	60·6
60·9	9·1	5·9	9·0	5·9	9·0	5·9	8·9	5·8	8·8	5·7	8·7	5·6	8·6	5·4	60·9
61·2	9·5	6·2	9·4	6·1	9·4	6·1	9·3	6·0	9·2	5·9	9·1	5·8	8·9	5·6	61·2
61·5	9·8	6·4	9·8	6·3	9·7	6·3	9·7	6·2	9·5	6·1	9·4	5·9	9·2	5·8	61·5

DIP					
Ht. of Eye	Corrⁿ	Ht. of Eye	Ht. of Eye	Corrⁿ	Ht. of Eye
m	′	ft.	m	′	ft.
2·4	−2·8	8·0	9·5	−5·5	31·5
2·6	−2·9	8·6	9·9	−5·6	32·7
2·8	−3·0	9·2	10·3	−5·7	33·9
3·0	−3·1	9·8	10·6	−5·8	35·1
3·2	−3·2	10·5	11·0	−5·9	36·3
3·4	−3·3	11·2	11·4	−6·0	37·6
3·6	−3·4	11·9	11·8	−6·1	38·9
3·8	−3·5	12·6	12·2	−6·2	40·1
4·0	−3·6	13·3	12·6	−6·3	41·5
4·3	−3·7	14·1	13·0	−6·4	42·8
4·5	−3·8	14·9	13·4	−6·5	44·2
4·7	−3·9	15·7	13·8	−6·6	45·5
5·0	−4·0	16·5	14·2	−6·7	46·9
5·2	−4·1	17·4	14·7	−6·8	48·4
5·5	−4·2	18·3	15·1	−6·9	49·8
5·8	−4·3	19·1	15·5	−7·0	51·3
6·1	−4·4	20·1	16·0	−7·1	52·8
6·3	−4·5	21·0	16·5	−7·2	54·3
6·6	−4·6	22·0	16·9	−7·3	55·8
6·9	−4·7	22·9	17·4	−7·4	57·4
7·2	−4·8	23·9	17·9	−7·5	58·9
7·5	−4·9	24·9	18·4	−7·6	60·5
7·9	−5·0	26·0	18·8	−7·7	62·1
8·2	−5·1	27·1	19·3	−7·8	63·8
8·5	−5·2	28·1	19·8	−7·9	65·4
8·8	−5·3	29·2	20·4	−8·0	67·1
9·2	−5·4	30·4	20·9	−8·1	68·8
9·5		31·5	21·4		70·5

MOON CORRECTION TABLE

The correction is in two parts; the first correction is taken from the upper part of the table with argument apparent altitude, and the second from the lower part, with argument HP, in the same column as that from which the first correction was taken. Separate corrections are given in the lower part for lower (L) and upper(U) limbs. All corrections are to be **added** to apparent altitude, *but 30′ is to be subtracted from the altitude of the upper limb.*

For corrections for pressure and temperature see page A4.

For bubble sextant observations ignore dip, take the mean of upper and lower limb corrections and subtract 15′ from the altitude.

App. Alt. = Apparent altitude = Sextant altitude corrected for index error and dip.

ALTITUDE CORRECTION TABLES 35°–90°— MOON

App. Alt.	35°–39°	40°–44°	45°–49°	50°–54°	55°–59°	60°–64°	65°–69°	70°–74°	75°–79°	80°–84°	85°–89°	App. Alt.
	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	Corrⁿ	
′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	′
00	35 56·5	40 53·7	45 50·5	50 46·9	55 43·1	60 38·9	65 34·6	70 30·0	75 25·3	80 20·5	85 15·6	00
10	56·4	53·6	50·4	46·8	42·9	38·8	34·4	29·9	25·2	20·4	15·5	10
20	56·3	53·5	50·2	46·7	42·8	38·7	34·3	29·7	25·0	20·2	15·3	20
30	56·2	53·4	50·1	46·5	42·7	38·5	34·1	29·6	24·9	20·0	15·1	30
40	56·2	53·3	50·0	46·4	42·5	38·4	34·0	29·4	24·7	19·9	15·0	40
50	56·1	53·2	49·9	46·3	42·4	38·2	33·8	29·3	24·5	19·7	14·8	50
00	36 56·0	41 53·1	46 49·8	51 46·2	56 42·3	61 38·1	66 33·7	71 29·1	76 24·4	81 19·6	86 14·6	00
10	55·9	53·0	49·7	46·0	42·1	37·9	33·5	29·0	24·2	19·4	14·5	10
20	55·8	52·9	49·5	45·9	42·0	37·8	33·4	28·8	24·1	19·2	14·3	20
30	55·7	52·8	49·4	45·8	41·9	37·7	33·2	28·7	23·9	19·1	14·2	30
40	55·6	52·6	49·3	45·7	41·7	37·5	33·1	28·5	23·8	18·9	14·0	40
50	55·5	52·5	49·2	45·5	41·6	37·4	32·9	28·3	23·6	18·7	13·8	50
00	37 55·4	42 52·4	47 49·1	52 45·4	57 41·4	62 37·2	67 32·8	72 28·2	77 23·4	82 18·6	87 13·7	00
10	55·3	52·3	49·0	45·3	41·3	37·1	32·6	28·0	23·3	18·4	13·5	10
20	55·2	52·2	48·8	45·2	41·2	36·9	32·5	27·9	23·1	18·2	13·3	20
30	55·1	52·1	48·7	45·0	41·0	36·8	32·3	27·7	22·9	18·1	13·2	30
40	55·0	52·0	48·6	44·9	40·9	36·6	32·2	27·6	22·8	17·9	13·0	40
50	55·0	51·9	48·5	44·8	40·8	36·5	32·0	27·4	22·6	17·8	12·8	50
00	38 54·9	43 51·8	48 48·4	53 44·6	58 40·6	63 36·4	68 31·9	73 27·2	78 22·5	83 17·6	88 12·7	00
10	54·8	51·7	48·3	44·5	40·5	36·2	31·7	27·1	22·3	17·4	12·5	10
20	54·7	51·6	48·1	44·4	40·3	36·1	31·6	26·9	22·1	17·3	12·3	20
30	54·6	51·5	48·0	44·2	40·2	35·9	31·4	26·8	22·0	17·1	12·2	30
40	54·5	51·4	47·9	44·1	40·1	35·8	31·3	26·6	21·8	16·9	12·0	40
50	54·4	51·2	47·8	44·0	39·9	35·6	31·1	26·5	21·7	16·8	11·8	50
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10	54·2	51·0	47·5	43·7	39·6	35·3	30·8	26·1	21·3	16·4	11·5	10
20	54·1	50·9	47·4	43·6	39·5	35·2	30·7	26·0	21·2	16·3	11·4	20
30	54·0	50·8	47·3	43·5	39·4	35·0	30·5	25·8	21·0	16·1	11·2	30
40	53·9	50·7	47·2	43·3	39·2	34·9	30·4	25·7	20·9	16·0	11·0	40
50	53·8	50·6	47·0	43·2	39·1	34·7	30·2	25·5	20·7	15·8	10·9	50

HP	L U	L U	L U	L U	L U	L U	L U	L U	L U	L U	L U	HP
′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′ ′	′
54·0	1·1 1·7	1·3 1·9	1·5 2·1	1·7 2·4	2·0 2·6	2·3 2·9	2·6 3·2	2·9 3·5	3·2 3·8	3·5 4·1	3·8 4·5	54·0
54·3	1·4 1·8	1·6 2·0	1·8 2·2	2·0 2·5	2·2 2·7	2·5 3·0	2·8 3·2	3·1 3·5	3·3 3·8	3·6 4·1	3·9 4·4	54·3
54·6	1·7 2·0	1·9 2·2	2·1 2·4	2·3 2·6	2·5 2·8	2·7 3·0	3·0 3·3	3·2 3·5	3·5 3·8	3·8 4·0	4·0 4·3	54·6
54·9	2·0 2·2	2·2 2·3	2·3 2·5	2·5 2·7	2·7 2·9	2·9 3·1	3·2 3·3	3·4 3·5	3·6 3·8	3·9 4·0	4·1 4·3	54·9
55·2	2·3 2·3	2·5 2·4	2·6 2·6	2·8 2·8	3·0 2·9	3·2 3·1	3·4 3·3	3·6 3·5	3·8 3·7	4·0 4·0	4·2 4·2	55·2
55·5	2·7 2·5	2·8 2·6	2·9 2·7	3·1 2·9	3·2 3·0	3·4 3·2	3·6 3·4	3·7 3·5	3·9 3·7	4·1 3·9	4·3 4·1	55·5
55·8	3·0 2·6	3·1 2·7	3·2 2·8	3·3 3·0	3·5 3·1	3·6 3·3	3·8 3·4	3·9 3·6	4·1 3·7	4·2 3·9	4·4 4·0	55·8
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